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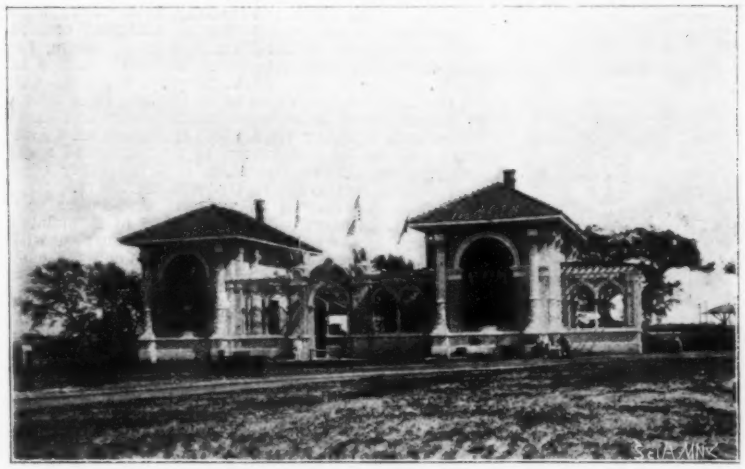
THE HUGUENOTS.

THE WOMEN'S BUILDING.

MOTHER AND CHILD.—By Elsie Ward.



NEW YORK STATE BUILDING.

PENNSYLVANIA STATE BUILDING.

THE CUBAN PALACE AT THE EXPOSITION.

THE CHARLESTON EXPOSITION.

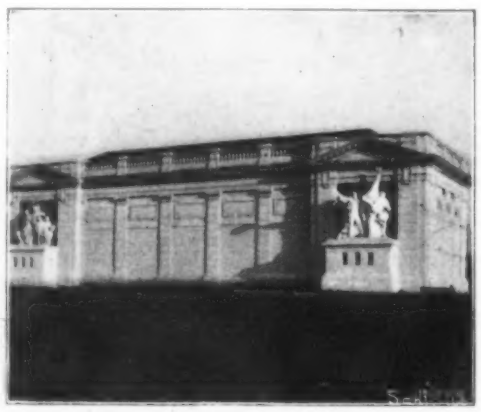
THE CHARLESTON EXPOSITION.

SITUATED not far from the temperate and tropic zones, the historic city of Charleston furnishes an opportunity of instructing the citizens of our country in the agriculture and manufactures, as well as the life of a tropical and semi-tropical part of the western hemisphere. The city may well be considered a key to the great commercial life that imbues the islands off our South Atlantic coast—islands that each year are becoming of greater commercial importance. Few seaports along the coast have the opportunity for exerting so stimulating an influence upon the growth and development of trade with the West Indies as Charleston. Only in an accidental way do most of us appreciate the importance of this West Indian trade; yet we sell more merchandise to the West Indies than to all the fifteen republics of South and Central America. Our Pan-American Exposition and Pan-American Congresses are all intended to stimulate a future trade with South America; but with the West Indies we already have a rich and growing trade that is but half developed. To us the West Indies must look for the greater part of their manufactured goods; for which reason these islands of the Atlantic, as a factor in American expansion, must prove of the greatest importance to the South.

In order to exhibit the resources and the industrial progress of the South an exposition is now held at Charleston, which is a worthy successor of those held at Atlanta, Nashville and Buffalo. The display of the products at the Exposition is good, and so thought out that the visitor is enabled to get a very comprehensive idea of tropical resources. Naturally in such an Exposition the chief exhibits are the products in which the group of South Atlantic States are most interested. These include cotton, sugar, tea, rice, and tobacco from the oldest and richest of our agricultural sections. Most of the cotton raised in this country comes from a group of States on the Southern Atlantic seaboard; and since cotton mills have become almost as numerous there as in New England, manufactured cotton goods would figure as important factors in the future development of that section. It is not without good reason, therefore, that the Charleston Exposition endeavors to draw the West Indian traders to a seaport which hopes to control trade in which are embraced all the islands in the Caribbean Sea.

Among the noteworthy buildings at the Fair are those of the States of New York, Maryland, Illinois and Pennsylvania. The special building of the city of Philadelphia also deserves mention. Twenty-four States and cities are represented in all by buildings and exhibits.

PHILADELPHIA BUILDING.



ART PALACE.

The most striking of the buildings is perhaps the Art Palace, designed by Mr. Bradford L. Gilbert, the architect-in-chief of the Exposition. Here, on its native heath, southern pine, the structural basis of all the buildings, is cheap. For that reason much more can be done for a given sum than elsewhere. The Court of Palaces, which is the equivalent of the Court of Honor at Chicago and of the Court of the Fountains at Buffalo, has, for example, cost less altogether than the Electric Tower at the Pan-American.

Many a New Yorker will be astonished to find at the Exposition some of the famous decorations that graced the Dewey Arch. How this came about is a simple tale. When the arch was ordered to be torn down and converted into junk it struck the architect of the Charleston Exposition that the decorations might well be used over again. That is why the Art Palace is now decorated with four groups of staff which adorned the piers of the arch. Against the plain and solid walls of the wings of the building the groups are displayed, two on each front. The central wall is decorated with double columns flanking the three entrances. At a distance from which the incongruity of naval and military groups for the decoration of an art building is not manifest the effect is excellent. At all events, whatever may be the effect, the sculpture is richer than anything that could be obtained with the means at hand.

The other half of the Fair grounds which adjoins the Art Building was nothing but a flat and deserted field one year ago. The Plaza, which occupies the central space, measures 1,200 feet by 900. More than half its length, and its whole width at one end, are lined with buildings, three "palaces" and their connecting colonnades. The effect of spaciousness is enhanced by the treatment of the whole Plaza as a sunken garden, with basins and fountains and tropical plants.

That the buildings of the West Indian group should have been designed in the "West Indian style" was inevitable. At Chicago and Buffalo the very same style went by the name Spanish-Renaissance, with special stress on any American modification it underwent in Spanish hands.

In this principal court the Cotton Palace, of necessity, occupies the post of honor. At one side it is flanked by the Building of Agriculture, and on the other by the Building of Commerce.

Facing the Cotton Palace at the entrance end of the Plaza is the very ample Auditorium, a semicircle like the Greek theaters.

As an architectural display the Charleston Fair will compare favorably with the Pan-American. In the Art Department more examples of early American painters are to be found than Americans ever believed could be discovered. Gilbert Stuart, Copley, Sully and the Peales are represented.

The fact that Charleston has a geographical location which makes it accessible to Northern and Southern cities should earn for it a popularity fully equal to that enjoyed by previous fairs.

THE VALUE AND INFLUENCE OF LABOR STATISTICS.*

By CARROLL D. WRIGHT.

THERE are now in the United States, besides the Federal Department of Labor, thirty-one State bureaus or departments devoted to the collection of statistics of labor by means of original investigations. Besides these, the Federal Census Office, the Bureaus of Statistics of the Federal Treasury and Agricultural Departments, the Bureau of Foreign Commerce of the Department of State, the departments and boards of agriculture of the various States, and various other offices may be considered as publishing labor statistics in some degree. But I speak here of the value and influence of those offices first mentioned—those devoted specifically and technically to the investigation of social and industrial conditions and to the publication of distinctive labor statistics. These offices had their foundation in the establishment of the Massachusetts bureau in 1869. Gradually other States created bureaus of statistics of labor, and in 1884 the United States government added its own office to those already in existence. All the offices, together, have published over 400 octavo volumes, covering a great variety of topics and the results of investigations relative to almost every condition and environment of the workingman.

The character and quality of the work of the different offices varies in some degree, due to a considerable extent to the short tenure of the heads of the different bureaus. Where the Governor of a State has allowed himself to ignore politics and insist upon scientific work, the bureaus have achieved the greatest success; but as a rule a Governor feels that the office of the chief of the bureau of statistics of labor of his State must be filled by somebody from his party, without reference to the skill, the experience, or the integrity of the incumbent under the previous administration. Yet I am glad to say, as the result of pretty careful study of the reports of all the officials who have done duty in this country during the past thirty-two years, that no matter for what reason they were appointed, no matter how inexperienced in the work of investigation and of compilation and presentation of statistical matter, no matter from what party they came, and whether in sympathy with capital or with labor, and even if holding fairly radical socialistic views—the men have, almost without exception, at once comprehended the sacredness of the duty assigned them, and have served the public faithfully and honestly, being content to collect and publish facts without regard to their individual bias or their individual political sentiments. As soon as a man realizes that he is giving to the world a fact he feels the necessity of accuracy, and that to distort the information collected would be to commit a crime worse than any ordinary lying, because it would mislead legislators and others and fix a falsehood in the history of the State. Many men, too, have come into the work of the statistical bureaus feeling that they could use them as the means of propagandism in some way, and in a few cases this has been attempted, but almost always with failure, because bureaus are looked to to furnish information relative to actual conditions surrounding industry.

That what I have said is true is illustrated by other countries following the example of the American States. Great Britain, France, Belgium, Austria, New Zealand, New South Wales, Canada, and the Province of Ontario, Canada, have established bureaus following in their duties very closely those assigned by law to the American bureaus and departments. In Germany, Italy, and Sweden labor statistics of the same character are published by general statistical bureaus. A distinguished member of the House of Commons of England told me a few years ago that whenever he wished to lay any facts relative to workingmen before his colleagues he carried into the House some American report on the statistics of labor. In the Chamber of Deputies of France, in the German Reichstag, and in the legislative bodies of other countries the American labor reports have been freely used in economic discussions. Had not the work of the American offices been highly regarded these things would not have occurred. It is true, of course, that the sentiment of the times is largely conducive to the successful operation of bureaus of statistics of labor. The general attention paid to social and industrial conditions and all conditions affecting the environment of men has fitted the soil for statistical seed. The altruistic spirit of this age calls for accurate information, that it may know how best to expend its efforts and not dissipate its energy. The question is constantly being asked: "What do social classes owe to each other?" And that any one class may not be deceived in the nature or magnitude of its debt, it must turn to statistics to ascertain the true situation.

The question is often asked, and by very intelligent people, Of what good is a bureau of statistics of labor? Does the workingman secure any direct benefits from its existence? This question cannot be answered very specifically, any more than could one asking for the direct benefits of the public school. It would be a difficult process to show how a dollar more is made to enter the pockets of the working people through the existence of the public schools, or any other educational institution, and yet all men will admit that the sum of benefits is largely increased by the existence of schools. Personally, I have always contended that the bureau of statistics of labor, wherever it exists, is simply a part of the educational machinery established by the community through which it is enabled to know more of itself. "Know thyself" is an injunction which should be applied to communities as well as to individuals, and it is only through rigid, impartial, and fearless investigations that any community can know itself in many directions. Notwithstanding this general view of the educational influence of the offices I am considering, very many instances of their specific influence can be cited. These instances I must, for purposes of convenience, draw largely from those which have come under my own observation or within my knowledge, for to enter upon a research of all the influences which have come in direct ways from the services of all the offices in existence in this country would take me too far afield.

One of the first results that I remember, as being traceable to a published report, related to the tenement house system of the city of Boston. In the second, third, and fourth reports of the Massachusetts Bureau of Statistics of Labor there were many facts showing the condition of the tenement houses in the city named. The public was fully apprised of the misery that existed in them, resulting from bad conditions, ill construction, and all that tended to make tenement house life an evil. Public attention was aroused through these publications, better laws were framed and passed, and a public sentiment created which crystallized in a reform movement having for its purpose the improvement of tenement houses in Boston. Some of the worst places were improved, and the impetus then given is still active, as is shown by the existence of societies in that city and their influence in securing from the Legislature an appropriation to enable the bureau in that State to make a very exhaustive investigation covering every tenement of whatever grade in the city of Boston.

The bureaus everywhere, whenever conditions warranted it, have investigated the subject of child labor and shown to the public all the facts connected with such employment, the evils it entailed upon the community, and the methods which could be resorted to for its reduction, and everywhere, too, the results have been beneficial. If the bureaus had never accomplished anything else than the marked reductions in the number of young children—those under ten years of age—who are employed in factories and workshops, they would have amply repaid the public for its expenditure in their equipment and support.

The publication of information relative to the inspection of factories and workshops in England and other countries, together with statistics showing the necessity for such inspection in this country, has led in several States to the establishment of boards of factory inspectors. These boards have committed to them the execution of all laws providing in any way for the benefit of those who have to work in any kind of productive establishments. These inspectors enforce the laws concerning the hours of labor, the employment of women and children, the guarding of machinery so that the operatives may be more free from accidents, and in all ways undertake the enforcement of all laws of the character specified. Through these efforts (and they were largely induced by the reports of labor statistics) child labor has decreased, accidents have been reduced in number and severity, the hours of labor have been shortened and recognized, and so all along that line of facts the influence of the reports of the bureaus has been enormous; the value of their statistics cannot be expressed by figures.

The first ten-hour law in this country was passed by the Massachusetts Legislature in 1874. The statistics published by the bureau of that State helped the passage of the law in a marked degree, and saved its repeal in later years. The manufacturers, finding that they were brought under the ten-hour law so far as minors and women were concerned, felt that the manufacturers in surrounding States ought to be brought under like laws or the law of Massachusetts should be repealed, for they claimed, as was claimed in England years ago, that in working under a ten-hour law the manufacturers of Massachusetts were placed at a decided disadvantage relative to the manufacturers in the surrounding States. The Legislature therefore directed the Bureau of Statistics of Labor to investigate the subject of the hours of labor in that State and in the other New England States. The result of the investigation showed that under a ten-hour system the Massachusetts manufacturers paid more wages than those in the other States, where eleven and twelve hours were the rule; that they produced more goods on any basis that could be named, whether per individual or per machine; in short, that in every respect the Massachusetts operatives were under better conditions than those of the surrounding States. There has been no attempt since that report was published to repeal the ten-hour law of Massachu-

* Revised by the author from an article in the Engineering Magazine.

setts. On the other hand, other States have followed suit, until now that system prevails generally in the United States.

The bureaus have been very influential in securing a modification of the old common-law rule relating to the liability of employers for accidents occurring to their employés. Under this rule a workman cannot recover damages for injuries received through the carelessness of negligence of a co-employé, although a stranger might recover damages for an injury following the same carelessness or negligence; as, for instance, under the old common-law rule, a brakeman on a train running perhaps 500 miles could secure no damages from a railroad corporation in consequence of injuries received through the carelessness or negligence of a switchman along any part of the line, although the brakeman knew nothing of the switchman, had no knowledge of his skill or capacity when he engaged with the company, and in no sense of the word, so far as reason is concerned, could be considered the co-employé of the switchman; yet, although that common-law rule grew up before great industrial enterprises were established, judges had adhered to it and had ruled that in such a case as that just mentioned the switchman and the brakeman were co-employés, and therefore the employer could not be held liable. The agitation for a legislative change in this common-law rule in England resulted in the enactment of a law in 1880 changing or modifying the rule, and, in this country, the matter being taken up by bureaus of statistics of labor, several Legislatures have been convinced of the justice of a change, and have therefore made it; the dire results which were predicted as sure to follow the change of the rule have not followed. In this direction the bureaus have done a great service, not only to the employés of railroads and corporations engaged in productive industry, but in securing the public against the employment of incompetent men.

Another very emphatic influence which the bureaus have exercised is in the abolishment or modification of what is known as the "truck-store" system, or, as it is more popularly known in some parts of the country, the "pluck-me" method of store trading. This system consists in the establishment of a store by the proprietors of a works for the supply of its employés. Formerly, in many instances, the prices charged at these stores were much higher than those charged at other places, and so the employé of a concern having a truck store was almost compelled, and in many instances actually compelled, to purchase the necessaries of life for his family at an exorbitant price, whereby the employer made a second profit on the labor of the employé. In very many instances the workmen of such an establishment never saw any money from one year's end to another. The pay for the goods purchased in the store was secured by the payrolls, and the debts and credits left no margin on pay-day. Early in the existence of bureaus of statistics of labor this system was attacked through the statistical method, and the result has been that in very many States laws have been passed making it a criminal offense, in some cases, to carry on such a system, and in other cases making it the duty of the proper officers to see to it that they are regulated. The evils of the truck-store system have not yet been entirely eradicated in this country, but the change has been great, and the value to the wage receiver of the greatest importance.

In this connection I might mention the influence which the bureaus have had in securing more frequent payments for the workingman. Formerly the payments were monthly. Under this system the credit system grew also, because without ready money the wage receiver must secure credit of his grocer, and the grocer, under such circumstances, looks out that the charges are sufficient to cover the delay in receiving his money or the losses which may come through his endeavors later on to collect the amount of his bill of the employer through the trustee or the garnishee system. Weekly payments have been shown by various bureaus to be beneficial in eradicating some of the evils of the credit system.

In some of the Western States there have grown up during the past few years some of the most rascally practices on the credulity of the workingman that have ever been known. They are robberies of the meanest sort, for they not only rob a man of his money, but in many instances of his manhood. The practice I refer to is that of a certain class of employment offices, located usually in the rear of some beer saloon, which advertise that a large number of men are wanted for labor in a certain city, but almost always at a distance. In a Western city one of these offices advertised for one thousand men to proceed immediately to Washington, D. C., where employment would be furnished at $1 per day. Hundreds of men responded to this advertisement. They were obliged to pay down $3 or $4, as the case might be or as the rascality of the manager might demand, and then the men were put off by various excuses for several days, until they began to clamor for their contract. When they became too demonstrative the manager would pay back a part of the sum advanced, for the sake of integrity. Meantime, however, these hundreds of men, loafing about his beer saloon, had expended more or less money for beer, in addition to the fee paid for the supposed employment. In one city an advertisement appeared for a large number of men to be shipped to Iowa, while in Iowa an advertisement appeared for a large number of men to be shipped to the very place of the first call. The bureaus in some of the States where such practices have been carried on collected the information relative to these offices, and exposed the swindle perpetrated upon the wage receiver. Much good was derived from these reports, and, in addition to the laws in existence, others of a more stringent nature followed.

These instances of the direct influence and value of bureaus of statistics of labor are sufficient, it seems to me, to prove beyond any question their right to exist, their right to the sympathy and support of the public, and their right to ample equipment and means for carrying on their beneficent work. But they have another office to perform, which is one of the leading offices of statistics in every direction, and that is the correction of false impressions and the removal of apprehension, and two or three instances of this kind may perhaps be of service.

The statement is usually made by writers on the labor question from the capitalistic point of view that the prosperity of the savings banks of the country represents absolutely the prosperity of the working man—that the total amount of savings in such banks clearly indicates the prosperity of labor. I am not disposed to question this statement, so far as it applies as a principle, but I question the degree of accuracy contained in it, for the investigations have clearly shown that only about one-half of the deposits in the savings banks belong to men and women engaged in manual labor or in the toil necessary to the production of goods. Such a fact, properly brought out, simply sets people's thoughts in the right direction, although it does not disprove the sentiment underlying the erroneous statements regarding the conditions involved.

In 1878 a great deal was said about the unemployed in this country. It was reported, and the report was very industriously circulated, that there were from 200,000 to 300,000 people out of employment in Massachusetts, 40,000 in the city of Boston alone, and 3,000,000 in the United States. These figures were quoted in newspapers, works on political economy, speeches in Congress, political resolutions, etc., until they came to be believed everywhere, and yet no attempt was made, officially or otherwise, to ascertain the real facts. The Bureau of Statistics of Labor of Massachusetts undertook to make an investigation of the subject, and this it did at two separate canvasses, one in June, 1878, and the other in November of the same year. The result showed that in that Commonwealth, on June 1, there were 28,508 skilled and unskilled laborers, male and female, out of employment, seeking and in want of work, and that in November there were not more than 23,000 of the same class. On these bases, there could not have been over 460,000 unemployed able-bodied men and women in the United States, ordinarily having work, out of employment at the time mentioned. The report further showed that in the State mentioned there were in 1875 only 316,459 persons engaged in manufactures and mechanical industries, in occupations upon which they depended for support, whether actually employed or not, and the whole number actually employed in the manufacturing and mechanical pursuits of the State was 308,963. If, therefore, there had been 200,000 or 300,000 persons out of employment in the State in June, 1878, as the alarmists were in the habit of stating, there could have been hardly any left in the factories and work-shops of the community. The figures published by the report were used all over the country, and completely reversed the popular belief relative to the vast number of the alleged unemployed in the country.

But I think one of the most striking instances of the removal of false impressions from the public mind relates to mortgage indebtedness on real estate. In a speech made in Congress in May, 1888, the statement was quoted from an agricultural paper that the estimated mortgage indebtedness of all real estate in Ohio at that time was $701,000,000; in Indiana, $398,000,000; in Illinois, $620,000,000; in Wisconsin, $250,000,000; in Michigan, $350,000,000; in Iowa, $351,000,000; and statements were made for other States. The Ohio and Michigan Bureaus of Statistics of Labor undertook to investigate this subject, through the offices of the registers of deeds, the boards of assessors, etc., and in these two States the mortgage indebtedness, as established and estimated by the Commissioners of Labor, was for Ohio, $330,999,205, and for Michigan, $129,229,553, instead of the amounts popularly claimed. Under the Federal census of 1890 an investigation was made relative to mortgage indebtedness, and the facts established with remarkable accuracy for the other States just named. By the investigation of the census it was shown that in Indiana the mortgage indebtedness is $110,730,643; in Illinois, $384,299,150; in Wisconsin, $121,838,168; and in Iowa, $199,774,171. It is a little remarkable that the sums accepted in a popular way for the mortgage indebtedness of the States named were in some instances exactly the valuation of all the property of the State. The extravagant figures quoted were used all over this country and in Europe, wherever capitalists were seeking investments in this country. The figures did immense harm; the wrong cannot be calculated; but as time goes on the statistics emanating from bureaus of statistics of labor and from the Census Office are removing the apprehension which grew out of the original statements.

Another feature relative to mortgages relates to the causes for which mortgages are placed upon farms in the western country. It has been claimed in recent years that the great mortgage indebtedness of western States is due largely to disaster or adversity. The Commissioner of Labor of Nebraska undertook to satisfy himself, by positive investigation, as to the truth or falsity of such claims, and he took as the territory for his investigation the county of Sarpy, covering the period from December 31, 1879, to January 1, 1890. Sarpy is one of the oldest counties in Nebraska, and it therefore offered the best opportunities for investigation in that State. The result, as to the causes for the creation of the mortgage indebtedness of the county, is shown in the following statement, taken from Commissioner Jenkins' report for 1889-90:

Purchase money	58.00 per cent
Permanent improvements	3.00 per cent
Purchase of stock.....	4.00 per cent
To meet personal obligations...	.50 per cent
To invest in real estate.....	7.00 per cent
To invest in mercantile business	20.00 per cent
Sickness	.25 per cent
Unknown causes	7.25 per cent

Allowing that all the mortgages from sickness and from unknown causes were the result of misfortune or of adversity of some kind, the foregoing table shows that 92½ per cent were for legitimate causes, and such causes as indicated prosperity rather than adversity.

The investigation under the eleventh United States census comprehends the object of indebtedness for 102 selected counties in several States, the results being obtained by personal inquiry through the experts of the office. That investigation is a clear and emphatic corroboration of the results arrived at by Commissioner Jenkins of Nebraska. It shows that to legitimate objects, indicating clearly prosperity and advancement, 94.37 per cent of all the mortgage indebtedness of the 102 counties considered must be attributed.

The convict labor question is one that has attracted a great deal of attention during the last quarter of a century, but it was not until various State bureaus and the United States Department of Labor collected exhaustive statistics relative to productive employments in penitentiaries and other penal institutions and showed the effect of different systems of employing convicts that the discussion took intelligent shape. There has been much reform along the line of convict labor. Many States have made experiments which have been abandoned, while others have established new systems which are progressing favorably; in the whole work the contributions of labor statistics have been of the greatest possible value.

The advancement of technical science, too, has been greatly accelerated by the exhaustive publications of different departments and bureaus of statistics of labor relative to industrial education. It is only recently that the different States of the Union have felt it incumbent upon them through their legislatures, to study all the phases of industrial training, consisting of manual training, trade school instruction, and the higher technology or university work which is done in our institutes of technology. The United States Bureau of Education has aided the discussion and consideration of such matters, and its work has been grandly supplemented by the State bureaus and the United States Department of Labor. It is now possible to discuss the question of industrial education in all its phases not only intelligently but on the basis of practical experience in this and other countries.

These few instances show the enormous value of statistics in removing apprehension and in correcting erroneous views. The money value of such information is not easy to calculate.

In September, 1883, the heads of the few bureaus of statistics of labor then existing met at Columbus, Ohio, and organized the National Convention of Chiefs and Commissioners of Bureaus of Statistics of Labor. Since then these officials have met annually for the purpose of discussing statistical methods and the best way of collecting information and of tabulating, analyzing, and presenting it. It was one of the early dreams of the founders of this convention that some uniform contemporaneous work could be undertaken by all the bureaus in co-operation, but this dream was fraught with many difficulties. States did not organize their bureaus at the same time. Many of the subjects which had been covered by those organized at early dates formed the subjects of investigation of those which had been established at later dates, and hence there was a conflict; for the earlier bureaus did not wish to cover again what was new and important to the more recently established ones. Another difficulty arose in the fact that the industries and conditions of one State were not common to all States having bureaus of statistics of labor. Notwithstanding the fact that the original idea has not been and cannot be carried out, the convention has been of the greatest possible value to the different States. At each annual meeting each Commissioner of Labor reports the investigations he has in hand, the methods he has adopted for obtaining the information desired, and all the difficulties and complications attending his work. These matters are then discussed and the experience of older Commissioners brought out for the benefit of those who have more recently come into the work of gathering statistics of labor. Thus great advantage is given to even the older Commissioners to gain fresh inspiration from the troubles and difficulties of those who are new to the work. The convention also helps to call public attention not only to the value but to the methods of the work being conducted.

Notwithstanding all that I have said relative to the value and influence of the statistics of labor, I am perfectly well aware that they could be made of far greater value; but that greater value can only be secured through the direct action of the legislative bodies behind the bureaus. They are very poorly equipped. They need more men and more money. They need experience, which can only come through the influence of the executives of the States. With a longer tenure of office and an increase in the equipment and means of the bureaus, their future usefulness can be made to far excel that of the past and of the present. The lines of work which they can undertake are numerous and inexhaustible. Knowledge of production is absolutely essential for the adjustment of many of the difficult questions we are facing today, and any contribution, through statistical investigation or otherwise, that will enable both the capitalist and his employé to more clearly understand the real conditions of production should be welcomed by all the elements of the community. The bureaus must be kept in the future, as in the past, free from partisanship. The statistician is not a statistician when he is an advocate, no matter how skillful he may be in the manipulation of figures. He must be impartial, he must make his investigations without any reference to theories to be proved or disproved, and give to the world the actual results of his inquiries. This country lacks trained statisticians. We have no means for training them, except in the practical work of the statistical offices of the State and Federal governments. These offices, therefore, become a school for the future, and the statisticians of this country that are to be of great service to the government must acquire their knowledge through the statistical offices; but no work can be accomplished successfully without money and without men. We must look, therefore, to the legislative branches of our various governments for the increase of the usefulness and for recognized influence of our bureaus of statistics of labor.

According to the Railway and Locomotive Engineering, the first charter ever granted in this country or probably any other, for the building of a railroad, bears the date 1819. The Pennsylvania Legislature granted the charter in question to Henry Drinker for a road from the Delaware Valley to the head waters of the Lehigh River—practically the route now controlled by the D. L. & W. Railway from the Water Gap to Scranton.

THE PARIS AUTOMOBILE SHOW.—I.

THE fourth Exposition Internationale de l'Automobile, du Cycle et des Sports that recently took place at Paris was baptized by the public by the name of "Salon de l'Automobile;" and to tell the truth, the automobile was the prominent feature of the exposition and totally suppressed the bicycle, which presented few improvements and attracted no more attention that it did when it "automobilized" itself by the addition of a small four-period motor to its frame.

As regards the automobile, the improvements that have been introduced are very numerous.

If we examine the modifications that have been made in the explosion motor we find in the first place that the sparking of the explosive mixture has been the object of very interesting researches.

The sparking accumulators upon carriages require very frequent recharging, an operation which it is quite difficult to effect in a satisfactory manner. M. Thomas has invented a small pocket apparatus (Fig. 1), which he calls the "Discret," and which permits of recharging these small batteries at the rate of ½ ampere, on condition that the ignition current utilized is continuous and does not exceed a tension of 120 volts. The apparatus is very simple. A contact socket leads the current to a resistance in the form of a 16 or 32 candle lamp installed upon a small plate of ebonite. A horizontal tube containing a special liquid and a point at each of its extremities shows, through the red color of such liquid, at which terminal the positive pole is located. Finally, two wires attached to the plate lead the current to the terminals of the battery.

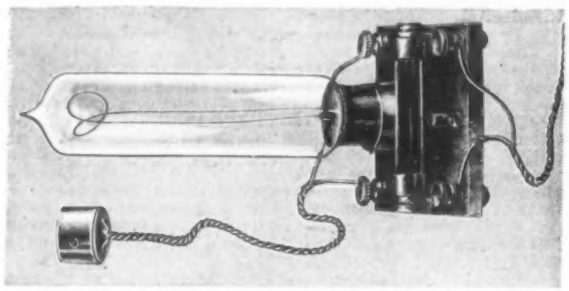


FIG. 1.—THE THOMAS RECHARGING APPARATUS.

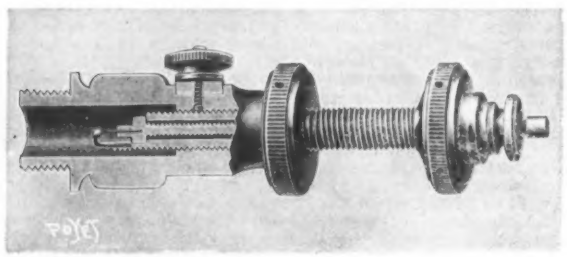


FIG. 2.—WYDTS ELECTRO-CATALYTIC LIGHTER.

But accumulators present serious inconveniences other than the difficulty of recharging them. Manufacturers show a marked tendency toward replacing them by magnetos or dynamos actuated by the motor itself. One of the most interesting dynamos is that of Panhard & Levassor. In a dynamo, as we know, the intensity of the current increases with its velocity of revolution. As the dynamo is controlled by a friction wheel upon the flywheel of the motor, and as the latter, under the action of the speed reducer or accelerator, is capable of taking on very variable velocities (about from 600 to 1,200 revolutions) at the will of the driver, the current might increase to the extent of grilling. The inventors have overcome the difficulty by mounting the dynamo upon an axis with central pivot, at the end of which is keyed the friction wheel, and which is controlled by a small ball governor. As soon as the velocity exceeds the number of revolutions a minute that the dynamo is capable of withstanding the balls fly apart, draw upon the oscillating shaft and break the adhesion of the friction wheel to the flywheel of the motor. The dynamo thus revolves at a constant velocity.

Finally, dynamos and magnetos themselves present certain inconveniences, the least of which are their complexity and cost. M. Wydts, an experienced engineer, has devised an electro-catalytic igniter that promises to work a revolution in the processes of sparking if experiment confirms it. The metals of platinum ore, as well known, possess the singular and unexplained property of producing a combination of the gases brought into contact with them. This catalytic action is so much the stronger in proportion as the metal is more divided. Oft-repeated experiments with spongy platinum have proved unsuccessful because of the fusibility of platinum at the temperatures attained by the interior of the explosion chamber of a gasoline motor, and also because of the fragility of spongy platinum.

M. Wydts has found an alloy of osmium, iridium and ruthenium which forming a metal of extreme porosity without losing the necessary density, resists the most elevated temperatures produced by explosions and causes an immediate ignition of the gases. The sole precaution to be taken consists in passing (at the start only and for twenty seconds) through the metal a very feeble electric current (½ ampere), which through molecular bombardment produces the expulsion of the gases condensed in the alloy. (Fig. 2.)

The advance and retardation of sparking are obtained through the optional displacements of the small mass of alloy in the ignition chamber in which it is mounted.

The question of sparking, however, is of no greater importance than that of the cooling of the motor. The explosions, in fact, disengage in the cylinder so many calories that the best oils burn in the valves of the apparatus. The motor is generally cooled by a current of water, which for the purpose of lowering its temperature and preventing evaporation, is made to pass into a radiator provided with flanges that increase its surface of radiation. The current of air produced by the carriage in motion strikes these flanges and cools them as well as the contents of the tubes that are provided therewith.

But certain automobile vehicles, such as trucks, etc., have but little speed, and all run relatively slowly when climbing steep hills. It follows that in these particular cases the current of air upon the flanges is null, and that the water is so much the less cooled in proportion as the motor does more work.

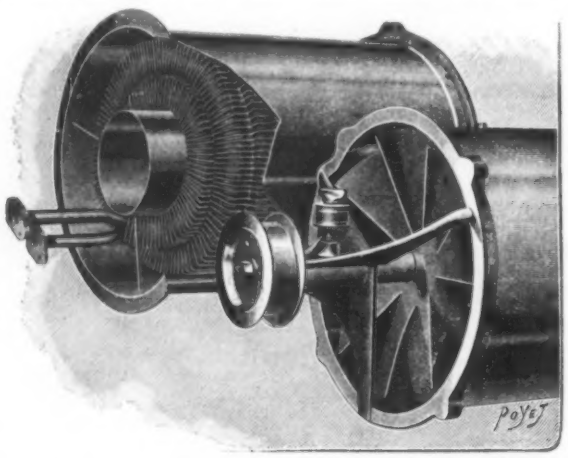


FIG. 3.—THE GROUVELLE AND ARQUEMBOURG MOTOR COOLER.

It has occurred to MM. Grouvelle and Arquembourg to produce such current of air mechanically independently of the speed of the carriage, and to this effect they have devised the cooler shown in Fig. 3.

The apparatus consists of a number of flanged tubes so arranged that the direction of the entrance of the liquid is contrary to the exit and behind which revolves a disk provided with blades and actuated by the motor. The current of air thus obtained moves at a velocity of 24 miles an hour and permits of reducing the amount of water carried in very considerable proportions.

If from the motor we pass to the mechanism properly so called, we find that the difficult question of the engaging and disengaging gear has received considerable attention. Thus in both the Bollée and Schandel carriages we see that the male and female friction cones have been removed from the driving shaft, which always revolves very rapidly, and transferred to the intermediate gearing shaft, which always has much less velocity. The difference between the actuating and actuated cones of the clutch is thus greatly reduced, and the starting is effected without jerks.

M. Camille Hautier has devised a gearing of this kind (Fig. 4) in which there is neither friction leather nor cones. The whole is entirely of metal and consists solely of spur wheels and a brake. The driving shaft carries a spur wheel, *A*. The transmission shaft, which is connected with it, carries a sort of T upon the small branches of which are mounted two other spur wheels, *B* and *C*. These small spur wheels mesh with the wheel, *A*, and also with an internal gear, the box, *J*, of which is loose upon the shaft and carries a brake drum, *E*. In order to communicate motion from the driving to the transmission shaft, what would be sufficient? A simple braking of the drum, *E*. In fact, if we prevent the box from revolving, the internal gear that it carries stops likewise, and the two spur wheels, *B* and *C*, actuated by the central one, *A*, begin to revolve and actuate the internal gear and its box; that is to say, to actuate in their motion the transmission shaft upon which they are mounted. If, on the contrary, we cease to brake the drum, the entire affair will immediately begin to revolve.

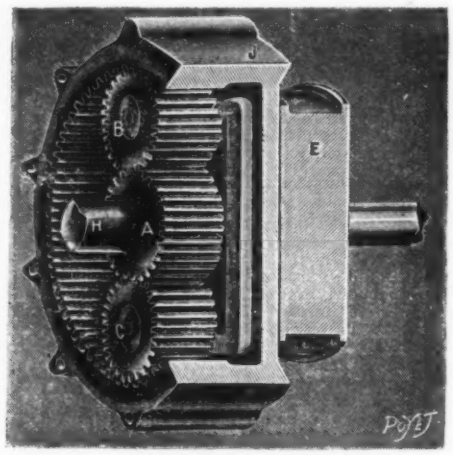


FIG. 4.—THE CAMILLE HAUTIER DISENGAGING GEAR.

This arrangement has the advantage of including no fragile member, nor any that is capable of rapid wear, and especially the advantage of producing a reduction of motion very favorable to the speed-changing gears, since the shaft that carries the spur wheels, *B* and *C*, revolves with four times less velocity than the driving shaft. When the driving shaft makes 800 revolutions a minute the transmission shaft makes but 200. The shocks and wear are therefore diminished by 75 per cent.

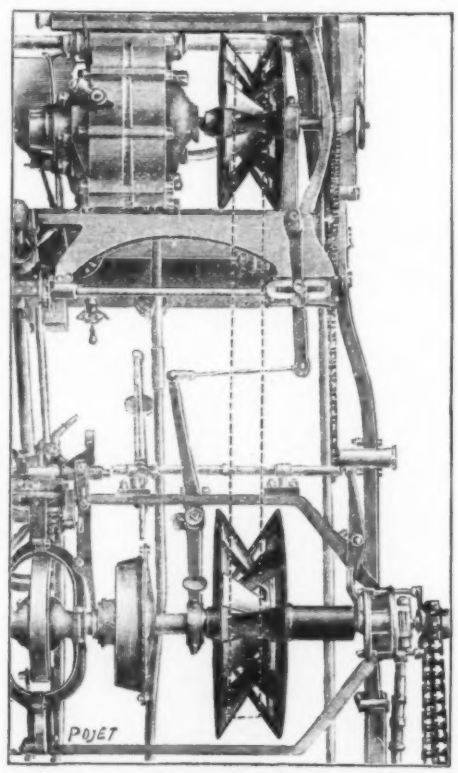


FIG. 5.—FOUILLARON'S EXTENSIBLE PULLEYS.

Finally, in connection with transmission properly so called, may be mentioned M. Fouillaron's innovation which replaces the series of gear wheels of different diameters by two extensible pulleys, one of which increases while the other decreases, as shown in Fig.

5, and which are connected by a chain belt, that is to say, by a flexible assemblage of pieces of leather of triangular section which offer the pulleys a maximum amount of surface in contact with the belt.—For the above particulars and the illustrations we are indebted to La Nature.

SOME ACETYLENE GENERATORS.

ACETYLENE generators may be divided into two classes:

1. Non-automatic generators.
2. Automatic generators.

In the first class a gas-holder is provided of sufficient capacity to contain all the gas which can be evolved from the largest charge of carbide which can

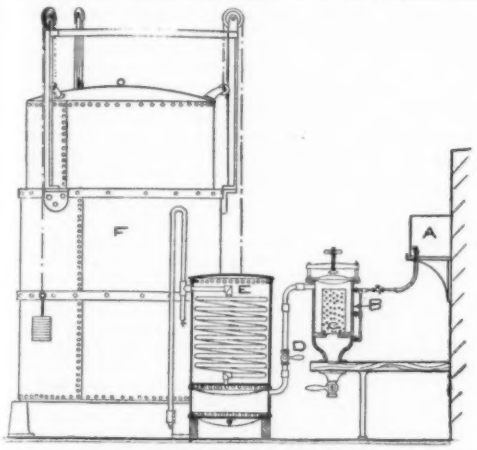


FIG. 1.—NON-AUTOMATIC WATER-TO-CARBIDE GENERATOR.

be placed in the generator; while in the second class the rate of generation is dependent upon the rate of consumption, the gas-holder is not usually of sufficient capacity to contain all the gas generated from a charge of carbide, and the supply of water to the carbide, or carbide to water, is automatically stopped when the gas is generated at a more rapid rate than that at which it is being consumed.

During the last six years several hundred forms of apparatus for generating acetylene by the action of water upon carbide, or carbide upon water, have been patented. Of these only a small portion are now on the market, but the number of survivors is nevertheless too large to admit of a description of each in these columns. A description of four of the different forms of generators in general use at the present time must suffice to illustrate the general principles of generator construction. Of these the first two are non-automatic, and the last two are automatic generators. In some forms of generator the carbide has to be used in a granulated condition, but as granulated carbide seldom yields so large a volume of acetylene as lump carbide, owing to the loss of gas which occurs when the carbide is crushed and stored, these generators are not, as a rule, economical.

The advantages of non-automatic generators over those of the automatic description are greater simplicity and safety, but they have the disadvantages of being more costly owing to the necessity of providing a gas-holder of comparatively large capacity, and of occupying a larger area of ground. When cost is not a primary consideration, non-automatic generators are, in the opinion of the writer, preferable to those of automatic form; but it is an indisputable fact that many automatic generators of a simple description are in operation in many parts of the country and are giving complete satisfaction to their owners.

When selecting a generator, attention should be given to the following points:

I. Excessive heating should not occur during the decomposition of the carbide. The lime sludge left after decomposition should not contain yellow compounds, tarry matter, or soot.

II. The air space in the generating chamber should be as small as possible, in order to prevent the formation of an explosive mixture of acetylene and air when gas is first generated after recharging.

III. No undecomposed carbide should be found in the generator when it is cleaned out.

IV. All parts of the apparatus should be well constructed in strong and durable material. Generators constructed with old salmon tins by amateur mechanics are liable to lead to disaster. Brass pipes or apparatus should be avoided, but stopcocks of brass may be used.

V. Not less than 4½ cubic feet of gas should be obtained from every pound of good commercial carbide placed in the generator.

VI. The gas pressure within the generator should at no time exceed 12 inches of water.

Non-Automatic Generators.—The generating apparatus known as "The Ideal" (Fig. 1) may be regarded as a type of the simplest and safest class of generators. It is non-automatic, since the admission of water to the carbide is regulated by the manual operation of a cock, and the generator is connected to a gasholder of sufficient capacity to contain all the gas which can be generated from a maximum charge of carbide.

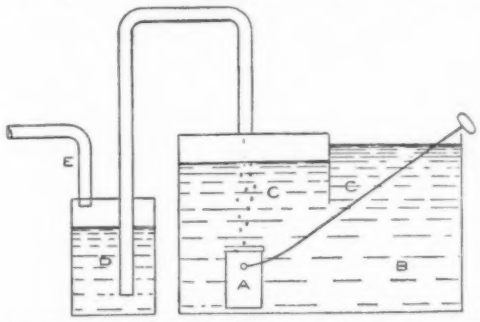


FIG. 3.—NON-AUTOMATIC CARBIDE-TO-WATER GENERATOR.

Water from the tank, *A*, is admitted to the generator, *B*, in which is situated a perforated basket, *C*, partially filled with carbide. The basket is introduced into or removed from the generator by taking off the cover, which is held in position by a screw and crosspiece as shown in the illustration. The water slowly rises within the generator, and soon comes in contact with the lower portion of the carbide. Acetylene gas is immediately generated, and passes through a condensing coil, *E*, from which condensed water is from time to time drawn off. From the condenser the gas passes into the gas-holder, *F*, or may be passed first through a purifier and then into the gas-holder. When the carbide basket is completely flooded with water, and gas ceases to be evolved, the water-supply cock and the cock, *D*, between the condenser and the generator are closed, the sludge in the generator is removed by opening the lever cock at the base, the carbide basket is removed and its contents discharged, and the apparatus is then ready to be recharged.

The water-tank is only slightly raised above the generator, and the gas outlet pipe from the generator is carried up higher than the top of the tank, so that it is impossible for the water to flow over into the condenser. The pipe which admits water into the generator is of very small bore, so that water cannot flow into the generator very rapidly, and in the event of any obstruction occurring in the outlet pipe from the generator the pressure of the gas within the generator drives back the water from the carbide before the pressure has become considerable.

The illustration (Fig. 1) shows a plant intended to supply sixteen acetylene flames, each consuming ½ cubic foot per hour, for a period of five hours without refilling the holder.

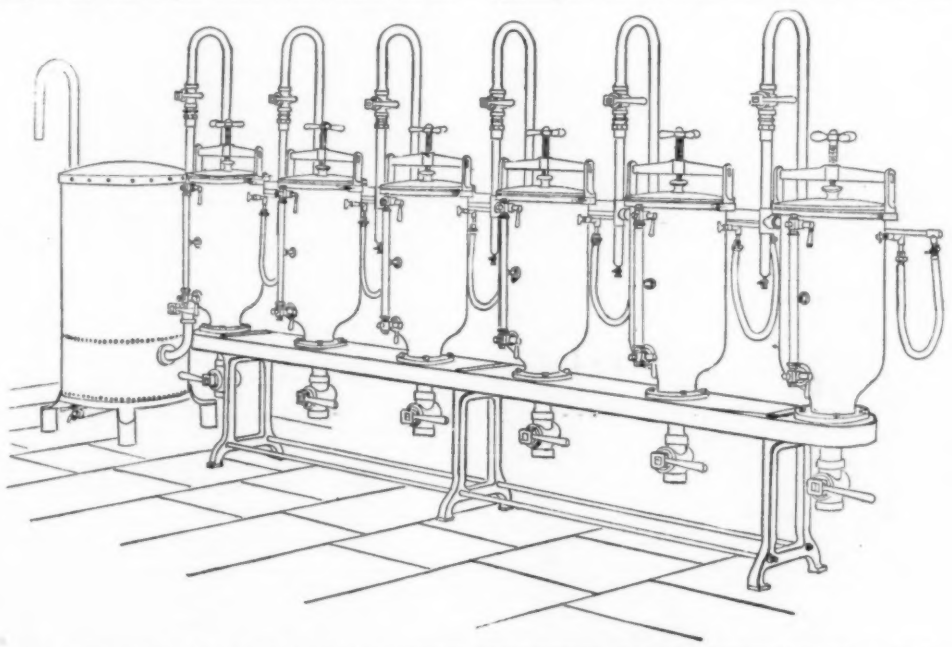


FIG. 2.—BATTERY OF GENERATORS WITH CONDENSER FOR CONNECTION TO A GAS-HOLDER OF 4,000 CUBIC FEET CAPACITY.

When the quantity of acetylene to be manufactured is large, a number of these small generators are connected in the form of a battery to one large gas-holder (Fig. 2).

This is preferable to making one large generator to contain all the carbide to be decomposed, because in decomposing a large bulk of carbide in this manner the heat accumulated within the generator during the period of decomposition is apt to be excessive. The generators are sometimes provided with water-jackets, but this is quite unnecessary, since no harm is done if the temperature of the generator does not rise above that which the hand can bear without discomfort, and there is no difficulty in decomposing the whole of the carbide without exceeding this temperature if the flow of water to the carbide is stopped when necessary. The battery of generators shown in Fig. 2 is connected to a suitable condenser, and is adapted to fill a holder of 4,000 cubic feet capacity.

Another form of non-automatic generator is that manufactured by the British Pure Acetylene Gas Syndicate (Fig. 3). This apparatus also has the merit of extreme simplicity. The carbide is placed in an iron pot, *A*, having a lid with a central perforation. This is plunged through a tank, *B*, which is open to the air, into a water chamber, *C*, which is closed (by *C'*) from the open air. The water slowly enters the carbide pot through the perforation, and the gas generated bubbles up through the water, and passes through a washer, *D*, and from thence passes through a pipe, *E*, to a gas-holder. When employing an apparatus of this type, a certain proportion of acetylene is lost owing to its solubility in water, and the water soon emits a disagreeable odor owing to the solubility of sulphureted hydrogen, ammonia, and other impurities in the water. The foulness of the water is not, however, a matter of importance when the generator is situated at some distance from the dwelling supplied with acetylene, and the fact that the water removes a considerable proportion of the impurities from the gas is some compensation for the loss of acetylene which occurs.—The Builder.

THE WATCH AND JEWELRY TRADE IN THE PHILIPPINES.

THE retail trade of all imported articles has been quite active, especially at the time of the payment of troops. The watch and jewelry stores of Manila, almost all conducted by Frenchmen, have been stocked with articles of moderate price, from fear of launching out too much for the future. The sales have been considerable, but the dealers have to incur a great deal more trouble than formerly and for less profit. Sometimes prices high enough are realized when soldiers, fortunate at play, come to the city; for they almost immediately convert their accidental gain into valuable jewelry.

But the French manufacturers do not profit entirely, for articles of American production are gradually finding their way into the stocks of the stores, and the supply is not likely to abate. Our manufacturers ought to keep in line with the jewelers of Manila, and endeavor to provide them with articles which can compete in quality and price with those manufactured in the United States. The French merchants of Manila usually have representatives at Paris, or else visit France occasionally, to keep in current with the novelties produced.

Gold, silver and nickel watches have all found customers; the natives who formerly looked with great favor on watches and jewelry of blackened steel now prefer nickeled articles. This is the result of their experience; for the steel referred to rusts with extraordinary rapidity in the warm, humid climate, and it is difficult to keep it in good condition.

This branch of trade is, unfortunately for the development of French industry, the only one represented in the Philippines by Frenchmen. As these dealers have obtained advantageous results in the past, and their profits to-day, notwithstanding the unfavorable circumstances, are not to be despised, it would seem possible to introduce other branches successfully.—Translated from the Bulletin du Commerce Extérieur.

THE UNITED STATES AND ASIA.

THE growing interest of the United States in the trade of Asiatic Russia and the countries tributary thereto lends especial interest to a statement just received by the Treasury Bureau of Statistics from a report of the Belgian Commercial Agent at Vladivostock, recently published in the Bulletin Commercial (Brussels). The statement is especially important in view of the fact that the commerce of Siberia has recently been brought under the general customs laws of Russia. The statement is summarized by the British Board of Trade Journal, as follows:

"The Vladivostock custom house, as is well known, commenced its functions on January 1, 1901. This measure has had a characteristic effect on the trade of the port, the import duties affecting principally manufactured articles, and scarcely touching products of prime necessity (except flour and rice) which are not produced in the country.

"The following is a list of articles that can be imported into Vladivostock free of duty: Fruits, fresh and dried; pineapple preserves; fresh oranges; kidney beans; green peas; potatoes, fresh and preserved; rice not decorticated; bread; mushrooms; citrons; salt; brick tea; chicory; beef and mutton; steel; steel and iron needles; steel, iron and tin-plate articles; iron and steel scales (except finely balanced kinds used by chemists); iron and steel machinery; iron and wire nails; iron and steel scythes; iron in bars; sheet iron; tin-plate; cast iron; rivets; tools; wheels; locks; tables; sewing machines; carpets and rugs; furniture; glass and glassware; alabaster; asphalt; bicycles; bottles; bricks; maps; books; straw baskets for flowers; leather straps; driving belts; musical instruments and pieces of music.

"Upon the closing of Vladivostock as a free port the traders in the place, who are few in number, and whose means are very limited, did not delay in turning this circumstance into account by increasing the price of articles which enter free in the same propor-

tion as those upon which duty is paid. Toward the end of 1900 large quantities of goods were imported into Vladivostock in view of the approaching closure of the free port, and at the present time the place is still overstocked with various articles which will take some time to be disposed of.

"The greater part of the merchandise imported into Vladivostock in 1901 was sent by way of the Amour and Manchuria. Commercial relations between this latter province and Vladivostock are developing rapidly, for, at the present time, it is Vladivostock which is supplying Manchuria by way of the Rivers Amour and Sungari and by the transsiberian railway, which is already finished as far as Harbin. Goods destined for Manchuria pay import duties at Vladivostock, but the amount is refunded after the goods have crossed the frontier. This, it is evident, complicates the transit trade, and it would therefore seem to be of advantage in these circumstances to use Port Arthur for goods able to bear the expenses of transport. Heavy merchandise, however, such as iron, etc., will probably continue to be sent via Vladivostock, the expenses of transport to Northern and Central Manchuria being much less onerous than from Port Arthur.

"Owing to the great fluctuations in the rates for transport into the interior exporters will do well to fix their prices c. i. f. Vladivostock or Port Arthur, so as to avoid the risk in transporting the goods by river or rail.

"The articles imported into Manchuria are the same as those usually exported to China, viz., manufactured articles, spirits, sugar, candles, window-glass, arms for Europeans, etc. Manchuria exports raw materials, viz., cereals, oil cakes, bristles, wool, etc."

SOUND SIGNALS.*

By E. PRICE-EDWARDS.

NAVIGATION near to land is acknowledged to be more difficult and dangerous than in mid-ocean. Out in the open expanse with plenty of searoom, a capable commander, with a good ship, is much more easy in his mind, even when the wind blows a gale and the waves run mountains high, than if he were near the coast among the narrow channels, the rocks and shoals, the lee shores, which threaten him on all sides. From the earliest period of navigation efforts have been made to set up marks and signs of the sea whereby the mariner might be assisted to work his vessel safely through the fringe of danger round the coast. In those old times castles, church steeples, towers, clumps of trees, and other prominent objects on the mainland offered themselves, and were used by seamen as guiding marks by day, and here and there a blazing fire was shown from a tower in the night time. Since those ancient days the condition of things as regards navigation has completely changed, and to-day the waters adjacent to the sea coasts in every part of the globe are traversed by vessels of all kinds, from the steam and sailing leviathans that carry on the maritime trade of all nations, to the small coasters that perform the local shipping service. To serve this enormous traffic, to help to safeguard the thousands of precious lives and the untold wealth of the commodities carried on board these innumerable ships, elaborate and costly lighthouses are set up which by night send forth powerful beams of light; lightships are moored in positions where by day they are like sentinels in the sea, and by night their flashing rays sweep the surrounding waters; thousands of floating buoys of various shapes, sizes and color (of late years many of them illuminated by means of compressed gas stored up in their bodies) are placed to define the navigable channels, or to mark the near position of hidden dangers.

THE NEED FOR COAST FOG SIGNALS.

In ordinary conditions of the atmosphere these numerous landmarks and seamarks render invaluable service to the vast array of ships that pass through coastal waters. But when fog settles down on the face of the sea the lighthouse stars of the first magnitude, the friendly rays of the lightship's revolving beams, the crowd of bobbing buoys with their winking lights, are all overwhelmed and rendered useless. Nothing is visible but fog; the perils of sea voyaging are greatly increased, and the captain is left alone with his compass, chart, and lead to make his way as best he can.

At such a time the mariner, with strained attention, can only grope his way slowly through the vague unknown, in anxious dread of getting out of his course, of stranding on a sandbank, or striking a rock, or of colliding with another vessel. In order to afford aid to mariners under such conditions, it was necessary to bring into operation some system whereby warning or guiding signals might be effectively conveyed to a befogged shipmaster which should tell him where he is and help him on his way, and up to modern times it has been found that sound is the only medium which can be made practically serviceable for this purpose. Therefore, earnest consideration has for many years past been given to the production of noise-making instruments of great power, capable of being heard at a serviceable distance. Most people will agree that in ordinary everyday life, especially in the large towns, there is already too much noise, and it may be thought that those who devote themselves to the production of the loudest and most penetrating sounds do not earn the gratitude of the bulk of their fellow creatures. Indeed, it may be remarked in passing that most of us would be better in health, happier in existence, and better tempered if the screeching of whistles, banging of doors, blowing off steam, and the eternal roar and rumble in our streets were altogether abolished. But the preceding remarks will show that there are occasions and conditions when noise making is raised almost to a fine art, and every effort is exerted to produce the most distinctive, the loudest, and probably most disagreeable sounds that can be developed. It is concerning these efforts as made by the lighthouse authorities of this and other countries that I have to address you this evening, and in doing so I must ask your patience, for the subject, though interesting enough to those connected with its practical application, has a tendency to be rather dry and tedious when brought to the notice of those who are not directly concerned with its working and development.

* Journal of the Society of Arts.

EXPERIMENTS OF 1874.

Twenty years ago I had the honor to address an audience in this hall on this same subject, and was then able to tell the story of some very important experiments which had been carried out in 1874-5 under the auspices of the Trinity House Corporation with the invaluable aid of Prof. Tyndall, who was at the time the scientific adviser to the Corporation.

PASSAGE OF SOUND IN FOG.

It was then demonstrated that, contrary to the generally received opinions, a condition of fog was not unfavorable to the passage of sound through the air—a most important consideration, because it showed that at the special time when no other form of signaling was available, sound could be used and would give its best effects, and also that results of experimental trials made in clear weather would be borne out and probably enhanced in foggy weather.

ACOUSTIC CLOUDS.

The theory of acoustic clouds in the atmosphere acting prejudicially on the propagation of sound in the atmosphere was also promulgated by Prof. Tyndall. Such clouds are said to be formed by air currents of varying temperature or vapor saturation, and the sound waves encountering these areas of different density are said to be reflected and re-reflected so that their energy is dissipated and lost. This theory, though most ingenious, does not appear to have met with unanimous acceptance in scientific circles, and doubts still exist whether it affords a true explanation of certain phenomena in regard to the disappearance of sound in fine, clear, and calm weather, which had been experienced during the South Foreland trials. But, however that may be, it does not materially affect the question of sending sound through fog, because, as a general rule, when fog prevails the temperature and saturation of the air are uniform over the foggy area, and the homogeneous condition so established is not favorable to the formation of acoustic clouds.

SOUND SHADOW.

Among other observed facts concerning the propagation of sound, which were brought to notice in the trials of 1874, it was shown that sound proceeding from an instrument set up on the coast may be seriously interfered with by projecting points of land, whereby an area of sound shadow may be formed beyond. Also that a somewhat similar effect was liable to be produced by sound waves striking the face of a neighboring cliff, the reflected waves so produced, if out of step with the direct waves, setting up such interference as to cause the direct sound to be greatly enfeebled, or even at times extinguished.

EFFECT OF WIND.

The general belief as regards the obstructive action of wind when blowing in a direction opposed to that in which the sound is projected was fully confirmed, it being recognized that an adverse wind of a certain force was fatal to the most powerful sound-producing instrument then known. As a result of this experience, Prof. Tyndall expressed the opinion that no signal could be relied upon to be heard at all times and under all conditions of weather for a greater distance than from two to three miles.

INSTRUMENTS IN USE.

Bells.—As regards instruments for producing sound which were in use at that time for signaling purposes, I may mention that bells of between three and four hundredweight were fitted at most lighthouses. The striking was effected by a clockwork arrangement, and the sound emitted seemed very powerful to an observer in close proximity to the bell, but its effective sound range was exceedingly limited, for bell sounds are wafted about by every zephyr that blows. In most cases the bells remain at the lighthouses to be made use of in foggy weather if no other more powerful sound producer is at the station.

Gongs.—The gong was formerly used as the special kind of fog signal for a lightship, but the weakness of its sound and failure of penetrating power have caused it to be superseded by other instruments.

Whistles.—Neither steam nor air whistles appear to have found much favor in this country. On the coasts of the United States they were and are still employed for fog signal purposes, and various examples were tested in the experiments of 1874, but they were regarded as wasteful instruments requiring about 70 pounds' pressure of steam, and their performance does not seem to have made a favorable impression on British ears, and the siren has proved to be a much more efficient instrument.

Guns.—The explosion of a 3-pound charge of gunpowder at the mouth of a gun has been frequently admitted to be a useful form of sound signal, and has been in practical service at various stations for many years. Its drawbacks have been stated to be that the duration of the sound is so short that it is liable to be obliterated by a local noise, or quenched by an opposing wind at a very short distance. In the trials at South Foreland two kinds of gun were included, viz., the long 18-pounder and a short howitzer.

Reed Horns.—When the experiments of 1874 were set on foot there had been in operation for a few years a reed-horn sounded with air compressed by Ericsson's hot-air engines, the whole fog signal apparatus being patented by a Mr. C. L. Dobell, of New York. Types of this instrument were tried at South Foreland.

Siren.—As the result of a visit of a Trinity House Committee to the United States in 1872 arrangements were made whereby a new instrument called a "siren" made from the design of Mr. A. F. Brown, of New York, should be sent for trial to this country, and it was included in the South Foreland experiments. To the principle of this instrument I shall refer further on.

RESULTS OF 1874 TRIALS.

Speaking generally in reference to the instruments tested in 1874, it may be said that the siren clearly demonstrated its superiority over all the other sound-producers with which it was compared as regards loudness and penetration, as well as the power of overcoming opposing influences, and that in consequence the siren principle has since been adopted for the large majority of coast fog signals set up on the British coasts, as well as for those on the coasts of France and other European countries, while in the United States its employment has been very considerably extended.

CHANGES SINCE 1874.

The foregoing abstract indicates the position of the fog signal question at the conclusion of the experiments of 1874. Since that period various changes and developments of more or less importance have occurred in connection with the instruments employed. Mechanical changes, of which I shall presently speak further, were made in the form of the siren; instead of direct steam, compressed air was used for sounding it, caloric engines, and more recently gas and petroleum engines, being used for compressing the air. A new method has been brought into use of differentiating sound signals one from another by means of combinations of high and low pitched notes, whereby the mariner should, on hearing a coast fog-signal, be able more readily to determine which particular station it came from. In this method the direct contrast of high and low pitched notes occurred in each signal, and by the use of a maximum of four sounds in one signal it was possible to obtain upward of twenty serviceable distinctions.

As regards the use of guns for producing explosive sounds, the introduction of guncotton had displaced several of the gun signals, with their 3-pound charges of gunpowder. It was found that the explosion of 4 ounces of guncotton in the open yielded quite as loud a noise as, and one of greater sharpness and intensity than, the discharge of 3 pounds of gunpowder from a gun, and also that this effect could be produced with a much less expenditure of labor. In the first practical use of the explosive a 4-ounce charge was carried up by means of a rocket to a height of about 600 feet, and there detonated; but more recently the charge has been suspended from the end of a long jib, and exploded by means of a small dynamo operated by the keeper in the lantern of the light house. The value of this form of sound signal is that it can be used at a lighthouse standing on a rock out at sea, where it would not be possible to place and work the machinery necessary for sounding a siren fog signal. For some positions, as at Flamborough Head, the rocket system is regarded as more suitable than the jib arrangement, in causing the explosion to take place at a height where its sound is free from local interferences, and so far removed from the light-house and buildings as to cause little or no inconvenience or risk. On the other hand, the jib system does away with the rocket and its tail of fire, as well as uncertainty attending its flight, and enables the signal to be fired with greater ease and precision by the attendant.

An improvement in the form of the siren trumpet has been adopted for use on board lightships. Instead of having a bent head (to be turned in any horizontal direction required) the vertical trumpet was mounted with what has been called the mushroom head, designed to distribute the issuing sound in a horizontal direction equally all round the circle. The arrangement is that an inverted cone is fixed just above the open mouth of a vertical conical trumpet, and the sound issuing from the trumpet strikes the curved sides of the cone and is reflected out all round in the direction of the sea horizon.

MATTERS REQUIRING EXPERIMENTAL TEST IN 1901.

This, I think, sufficiently indicates the changes and supposed improvements which had been brought about since the experiments of 1874—changes justified, no doubt, on theoretic grounds, but requiring, it was thought, the seal of experimental test. Other questions also had arisen requiring such test, viz., in regard to the relative efficiency of high and low notes; the most effective method of covering a sea area with a warning sound, whether by one large instrument with trumpet pointed against the wind, or with two smaller instruments and trumpets fixed at a suitable angle to embrace the whole arc to be guarded; the relative merits as sound producers and fog signals of the siren and the reed horn as most recently developed; the value of a new form of disk siren, and some novel forms of trumpet as designed by Lord Rayleigh. It was also desired to make some further observations in reference to the distribution and penetration of sound through the atmosphere, having regard to some anomalous occurrences which had been experienced in connection with some established coast fog signals.

Accordingly the Elder Brethren of the Trinity House, as the principal lighthouse authority, with the co-operation of the authorities for Scotland and Ireland (who have set up sound signals round our coast), arranged for a series of trials to be carried out at the fog signal station attached to the electric light establishment at St. Catherine's Point in the Isle of Wight, where there was in operation a first-class siren, and where steam power was available. A Special Committee of the Board was appointed, with the Deputy-Master of the Trinity House as Chairman, the committee having also the invaluable assistance and advice of Lord Rayleigh, and of Mr. T. Matthews, the engineer-in-chief to the Corporation. The locality chosen, as will be seen by the chart, afforded ample scope for making observations at sea at any required distance over a wide area of 280 deg. in arc, and the Trinity House steamer "Irene" was detailed for conveying the observers from point to point as desired. On the 8th of May last the actual trials and observations were commenced and were carried on day by day in a practically continuous manner until June 13, the observations being made in a systematic manner by each observer on cards specially prepared for the purpose. No less than 4,600 observations were thus recorded, which were afterward carefully tabulated and summarized, and the results obtained by this process were found to be

quite in accordance with the general opinions formed by this observing committee.

It is proper here to state that before entering upon their investigation the committee considered whether they should include trials of schemes for conveying signals to a befogged mariner by other means than sound. Several projects to be actuated by electrical methods were proposed for trial, including the apparatus of Mr. Marconi, and other inventors or patentees, for establishing communication by means of etheric vibrations. Reference was also made to a plan for transmitting electric impulses from shore through a submarine cable, which within a certain area in the vicinity of the cable would induce responsive electrical impulses in a suitable receiver on board a vessel coming within such an area. But it did not appear that these projects were in such a condition of development as to enable them at once to be subjected to practical trial in connection with the objects of the inquiry; it was also thought that merely tentative experiments in regard to the possibilities of the schemes would occupy a very considerable length of time, and necessitate a correspondingly large outlay, with the possible result that they might after all prove of no real service. Of course, it is greatly to be desired that some method of this kind may in course of time be successfully made available for conveying warnings in foggy weather, for it would possess the great advantage of being independent of the capricious influences of the atmosphere, but it may be well for a moment to consider one or two points in this connection which may not be generally apprehended. The real value of a sound signal to a mariner in a fog at sea is that on hearing it he can form a fairly approximate idea of the direction from which it comes, and is thus able to keep away from it. In the case of etheric vibrations a received message may indicate the name of the station from which it proceeds, but where that station is situated relatively to the receiver, the message gives no information whatever; it can only be said to come from the circumambient space. Again, a sound signal will give him some general idea of his distance from the station, say, within 10 miles, but an etheric message may come to him from any distance, without giving him any idea of how far he is from the signaling station. Considering the enormous distances across which it is claimed that these etheric signals may be transmitted, it is conceivable that he might receive such messages from all parts of the United Kingdom and even from the coasts of the North American Continent. Undoubtedly in such a case the mariner might complain that he was having too much of a good thing. Take, again, the project of supplying electric impulses sent from shore through a submarine cable lying on the sea bottom, with the object of inducing responsive impulses in a suitable receiver on board a ship within a certain area of influence. A trial was made by the Royal Commission on Electrical Communication between lightships and the shore of a plan of this kind at the Goodwin Lightship, which was fitted with an elaborate arrangement of insulated wire coils in which it was hoped induced currents would be generated, but the Royal Commissioners report that it was found impossible to effect communication by means of the system, the electric energy being almost entirely lost in the sea. It is impossible to say what the genius of Mr. Marconi, and others who are working in the same direction, may ultimately accomplish; the application of the remarkable results obtained is at present quite in its infancy, but should the difficulties I have referred to be in time overcome, so that the system could be effectively applied for fog signal purposes, no one would welcome it more gladly than the authorities charged with the duty of indicating the dangers and safe courses in the waters adjacent to our shores.

What I have now said has reference only to the application of these methods for fog signal purposes. As a means of communication between outlying stationary lightships and the shore, there is every reason to hope that the system will before long be practically applied.

INSTRUMENTS TRIED AT ST. CATHERINE'S.

We will now turn our attention to the sound-producing instruments subjected to test at St. Catherine's. For reasons which I need not here enter upon, the instrumental trials were a good deal devoted to comparisons of efficiency between the siren principle and the reed principle of producing sound, and between modified forms of each type.

The two methods of producing sound are doubtless more or less familiar to all present this evening, but a brief description of their application for fog signal instruments will not be out of place.

THE SIREN.

For all fog signal instruments giving blasts of sound a certain pressure of air or steam is essential, in practice ranging from 10 to 40 pounds on the square inch. By force of this pressure the air or steam is urged through a pipe of comparatively small diameter into the trumpet, and thence out into the open air. But in the throat of the trumpet and in the direct course of the air or steam current is interposed the instrument which produces the sound. In the case of the siren the instrument now in use consists of a fixed cylinder with a certain number of longitudinal slits through which air or steam under pressure may pass to the interior. Inside this cylinder and fitting it very closely is another cylinder of similar pattern, with slits corresponding in number and shape to those in the outer cylinder, but capable of being rotated at a considerable speed. In this cylinder (5-inch, as used at the St. Catherine's station) there are 24 longitudinal slits or ports as they are usually termed, and it is clear that on the inner cylinder making one complete rotation, 24 coincidences of the ports take place. Assuming that 240 complete rotations occur in one minute, there will be 5,760 coincidences in that time, or 96 in each second. This would be a slow rate of rotation, but it is a convenient one for illustration. Around the outside of the outer cylinder the air under considerable pressure awaits an opportunity for escape, which is afforded at each coincidence, when a short, sudden and intense puff bursts through the coinciding ports into the interior space communicating with the trumpet, striking a sharp blow upon the air in the open trumpet. The rapid succession of these impulses creates sonorous waves, the length and musical pitch of which are, as is well known, determined by the speed of the rotation of the siren and the consequent number of vibrations produced in a second. When first used for sound-signal purposes the siren was not cylindrical, but consisted of two flat disks with equal number and size of slits, one fixed, the other rotating. The change to the cylinder form was thought desirable as being a more effective mechanical arrangement than the disks and as lending itself more readily to being self-driven by the air pressure. But experience has shown that the automatic rotation by the air pressure involves a possible loss of power and a more or less defective blast. In the automatic blast the speed of rotation of the siren commencing from a condition of rest involves an upward run through many degrees of speed to reach the required rate of rotation, the resultant sound beginning to be audible with a very low note, and running rapidly up to the required pitch. Thus the duration of the proper signal sound is shortened, and an effect produced which is not wanted. It is intended to remedy this defect by employing a separate motor to rotate the siren, whereby the rotation can be brought up to its proper speed before the air pressure is applied, and uniformity of pitch thus secured throughout the period of the blast.

Two sizes of cylinder siren were tried at St. Catherine's, viz., one of 5-inch diameter, as used in the Trinity House service, and one of 7-inch diameter, as used in the Scottish service, with some variations as regards the size and number of the ports regulating the volume of air passing through at each blast. Also, one new experimental form of disk siren, 7 inches in diameter, was also tried.

THE REED.

A few words now are necessary in reference to the opposition principle of producing blasts of sound, viz., the reed. In this case the sound is produced by the vibration of a more or less elastic metal tongue fixed in a box, into which the air under pressure enters periodically, and finds an outlet into the associated trumpet through an orifice which is covered by the metal tongue. The air pressure acting upon this reed causes it to vibrate, the effect being the orifice is alternately opened and closed; opened by the air pressure, and closed by the resilience of the metallic tongue. These alternations follow with great rapidity, and at each opening a small quantity of compressed air escapes, and the air in the trumpet receives a short, sharp shock, as in the case of the puffs through the siren. A careful adjustment of the reed is necessary, so that when the air pressure is applied the number of its vibrations shall correspond to the note pitch required. Too much air and too forcible a pressure may act detrimentally on the performance of the reed.

Four reed instruments were tried at St. Catherine's, viz.:

1. The Stentor fog-horn (of Dutch origin), with one reed, sounded at the very high pressure of 120 pounds on the square inch—265 vibrations per second.
2. The Barker reed horn, as used at Belfast, with three steel reeds, sounded at 40 pounds pressure—about 353 vibrations per second.
3. The Taylor reed horn, with at first six, and afterward two reeds, sounded at 40 pounds pressure—about 353 vibrations per second.
4. The Trinity House service reed horn, with one steel reed, 3 5-16th + ¾, sounded at 15 pounds pressure—at first 496, afterward 397 vibrations per second.

COMPARATIVE TRIALS.

The comparative trials made with these instruments may be classed as follows:

1. Sirens v. sirens.
2. Sirens v. reed horns.
3. Reed horns v. reed horns.

SIRENS V. SIRENS.

The fog signal established at St. Catherine's for actual service consists of two 5-inch cylinder sirens with two turmpets. The seaward arc over which it is desired to spread the sound is about 220 deg., and the two trumpets are so fixed that their mouths cover that arc. The apparatus is arranged to give two blasts, one with a high note, one with a low note, every minute, each note being sounded by the two sirens working simultaneously, emitted from the two trumpets at the same time. Thus the combined sound of two sirens for each note is thrown over the arc required to be guarded. On the other hand, it was thought by some that the sound would be more effectually distributed by using a larger and more powerful siren, requiring more air and greater pressure for the blast, and pointing the trumpet as nearly as possible to the windward part of the arc. This question was put to practical test, viz., St. Catherine's two-siren system v. the system of one large siren and trumpet pointed to windward. The observed results showed that when in or near the axial line of the single trumpet with the large siren its sounds were distinctly more powerful than those of the double siren arrangement, though the latter gave useful sounds at the same time. The wind on this occasion was not strong and the sea was smooth, and it is only fair to say that the line along which the observations were made, i. e., the medial line between the two trumpets, apart from the slight opposing wind, was the least favorable for the St. Catherine's signal. Over the remainder and much greater part of the arc and in the rear of the large trumpet the position was reversed, the St. Catherine's sounds coming out with superior effect especially in the axes of their trumpets, while down to leeward the sounds of the single large siren fell away to feebleness, the St. Catherine's sounds being plainly heard all the while. From these comparisons it is concluded that the double-trumpet method is on the whole better for covering a wide arc with sound than the more powerful instrument directing its force through a single trumpet against the wind. This large 7-inch cylinder siren rotated by a separate motor and sounding very low notes was sent for trial by the Scottish Lighthouse Board, and it proved itself to be a very effective sound-producing instrument. Undoubtedly if two such sirens and trumpets of this kind had been fixed in a similar manner to those of St. Catherine's the result would have been most favorable to the Scottish instruments, but it would have involved a much greater expenditure of power, seeing that one such large Scottish instrument required a higher pressure, with a larger volume of air for blast than the two St. Catherine's sirens, and a consequent larger absorption of horse power.

The trial of the new experimental form of 7-inch disk siren gave some interesting results. It was fitted in a vertical trumpet with bent head, and, with a slow rate of rotation by means of a separate motor, was arranged to sound one very low-pitched note—the St. Catherine's signal being used as a standard of comparison—but as the disk trumpet was directed on the medial line, the two St. Catherine's trumpets were turned in, so that their axes inclosed an angle of 37 deg. instead of 120 deg. as usual. The weather was fine and clear; wind easterly, light. At the commencement of the observations at a short distance from the station, the observers were astonished at the loudness of the sound from the disk siren; it filled all the air, and, to use an old expression, it made the welkin resound. At eight miles distant, the sounds of the disk siren were overwhelmingly predominant, while those of St. Catherine's were falling off; at ten miles St. Catherine's sounds were lost, but those of the disk siren still retained their strength. The "Irene" proceeded at full speed on to a distance of 20 miles, the blasts from the disk siren being heard plainly, and as effective sounds throughout. At the distance of 20¼ miles it was necessary for the "Irene" to return; the sounds were still loud and distinct, and would doubtless have been audible at a much greater distance. In subsequent comparisons in similar quiet weather the disk siren proved superior to the 7-inch cylinder siren with its low notes, but not to the same extent as in the trial with St. Catherine's. A different result, however, was experienced in different weather. On several occasions, with opposing wind and agitated sea surface, the low notes of the 7-inch disk siren proved inferior to the higher notes of the St. Catherine's and Scottish sirens, and in one instance with a wind of force 4 and the sea rough, "Irene" rolling, when a comparison was being made of the Scottish 7-inch cylinder with the 7-inch disk, no sounds were heard at two miles distance, and they were only picked up at 1¼ miles. I shall refer again to the question of the influence of wind, weather, and pitch of note on the transmission of sounds through the atmosphere. At present I am simply recording actual results of trials, and specially pointing out that an instrument which on one occasion transmitted its sound for over 20 miles, was on another occasion, under different conditions of weather, not audible beyond 1¼ miles.

(To be continued.)

"THE WORLD'S SUGAR PRODUCTION AND CONSUMPTION, 1800—1900."

THE above is the title of a monograph just issued by the Treasury Bureau of Statistics. It discusses the sugar production and consumption of the world during the past century, and especially during the last half century, in which the burden of sugar production has been transferred from cane to the sugar beet, and in which the world has so largely increased its consumption of sugar. The world's sugar production has grown from 1,150,000 tons in 1840 to 8,800,000 tons in 1900. During the same period the world's population has grown, according to the best estimates, from 950,000,000 to about 1,500,000,000. Thus, sugar production has increased about 650 per cent while population was increasing but about 50 per cent. Coming nearer home and considering the United States alone, it is found that the consumption of sugar, which in 1850 was only 22 pounds per capita, was in 1901 over 68 pounds per capita.

One especially striking fact shown by the statistics presented in this study is the rapidly increasing proportion of the world's enlarged sugar consumption which is supplied by beets. According to the figures presented by this study, beets, which supplied in 1840 less than 5 per cent of the world's sugar, in 1900 supplied 67 per cent of the greatly increased consumption; while cane, which then supplied 95 per cent of the word's sugar consumption, now supplies but 33 per cent. Stated in quantities, it may be said that the world's cane-sugar supply has grown from 1,100,000 tons in 1840 to 2,850,000 tons in 1900, an increase of 160 per cent; while that of beets has grown from 50,000 tons in 1840 to 5,950,000 tons in 1900, an increase of 11,800 per cent.

The figures above quoted include that portion which enters into the world's statistical record of sugar production, and does not include the large quantities of cane-sugar produced in India and China exclusively for home consumption, and in a considerable number of the tropical countries does not include that portion of the sugar consumed at home. Even if these figures of cane-sugar production for home consumption were obtainable, the production from beets would still show a much more rapid growth during the last half century than that from cane. This is, apparently, due to two great causes: (1) the elimination of slavery in the tropics, the seat of the principal sugar production; and (2) the intelligent study of and government aid to the production of beet sugar in the temperate zone especially in European countries.

One effect of this enormous increase and the competition which has accompanied the development above alluded to has been a great reduction in prices to the consumer. The figures of the Bureau of Statistics, obtained from statements supplied by importers of the cost in foreign countries of the sugar which they import, show that the average cost of the sugar imported in 1871-2 was 5.37 cents per pound, and in the year 1899-1900, 2.49 cents per pound.

The sugar production of France has grown from 23,000 metric tons in the sugar year 1839-40 to 805,000 tons in 1899-1900; that of Germany, from 12,659 metric tons in 1839-40 to 1,875,000 tons in 1900-1901; Austria-Hungary, from 25,000 metric tons in 1853-54, the earliest date for which figures are obtainable, to 1,120,000 tons in 1899-1900; Russia, from 19,000 metric tons in 1853-54 to 900,000 tons in 1899-1900; Belgium, from

12,000 metric tons in that year to 300,000 tons in 1899-1900; Holland, from 1,000 metric tons in 1860-61 to 180,000 tons in 1899-1900. Turning to the cane-sugar producing areas, in which the statistics are not available for so long a period, it is found that the exports from the Philippine Islands increased from 23,416 metric tons in 1849 to 233,000 metric tons in 1896. From Cuba the exports in 1860 were 537,491 tons, and in 1894 968,750; in Hawaii the production has grown from 11,200 tons in 1875 to 243,470 tons in 1899. Java produced in 1884, 338,866 tons and in 1901, 765,000 tons; and Brazil, which in 1884 produced 268,335 tons, produced in 1901, 215,000 tons.

The table which follows shows the world's production of sugar from cane and beets, respectively, at decennial years from 1840 to 1900, and the percentage supplied by beets:

Year.	Cane Sugar. Tons.	Beet Sugar. Tons.	Supplied by Beet. Per cent.
1840	1,100,000	50,000	4.35
1850	1,200,000	200,000	14.29
1860	1,510,000	389,000	20.43
1870	1,585,000	831,000	34.40
1880	1,852,000	1,402,000	43.08
1890	2,069,000	3,633,000	63.70
1900	2,850,000	5,950,000	67.71

THE SOLDIERS OF THE ALPS.

IF one wishes to form a good idea of the life of the Alpine soldier, of his perils and sacrifices, one should read the Margueritte brothers' romance "Le Poste des Neiges," which describes it in detail.

The book opens with a description of a ball one winter evening at the Préfecture at Chambéry. In the midst of the fête, a young officer, the ruling spirit of the ball, learns that a comrade has fallen down an abyss, and been found lying in the snow and cold, with both legs broken. The officer immediately quits the pleasures of the ballroom, dons his mountaineer trappings, and, leaving the bright winter quarters at Chambéry, goes to replace his injured comrade at an isolated post on the mountain top, among avalanches and glaciers. His life here throughout the winter, and all the dangers and hardships he endures, are graphically portrayed in this book.

A few weeks ago also, there was a grand ball at Chambéry. The ball was at the house of the prefect, or the mayor, and the officers of the 32d—drawn from the 13th Alpine or from the mountain battalion of the 97th infantry—were at the fête, in a joyous and happy mood.

Suddenly word was received of an accident. A whole company of the 13th Alpines had been swept away by an avalanche!

Whose turn was it to leave the ball and go to succor their wounded comrades or relieve them at their post of honor?

The alarm had no sooner been given when the lights of the fête were extinguished, and the catastrophe of the 22d of December, in Arrondaz Pass, had brought out to face new dangers the Alpines of Maurienne, the guards of Savoie. This time the Alps had laid violent claim to their tribute of victims. They had snatched away at a single stroke six strong, hardened, and valiant young men. These young men formed part of a party of eleven from the Frejus post, whose duty it was to watch the heights of Bardonnèche (8,530 feet in height) and of Joffereau. It is over these heights that the Italian infantry stationed on the plateau of Mont Cenis, where they winter at ease in comfortable barracks, could suddenly pass, reach Modane, and take possession of the tunnel. A company of the 97th infantry guards the Frejus Pass. It should be stated that in this region we have regular soldiers of the line similar to the Alpines. Thus the 97th, with barracks at Chambéry, has a whole battalion which has its own special life and almost its autonomy like the 13th battalion, its comrade and neighbor.

The eleven men from the Frejus Pass were to meet a squad from Modane bringing provisions for the thirty soldiers wintering at the pass. The two parties were to meet about half way. The squad that left the post under the guidance of a sergeant had gone a third of their perilous journey, when an avalanche came sliding down over the huge rocks of the Ardondaz Pass and hurled them from their accustomed path down the dizzy depths below. The men were roped together in two parties, one made up of five men and the other of six. The rope connecting the five men caught on a telegraph pole and held them, but the others disappeared.

A long and perilous search for the victims was made by their comrades of the 13th cavalry and 97th infantry, aided by the firemen of Modane. The grief and emotion of the officers were profound. The general of the Arvers division, one of those chiefs with a great soul in which beats the heart of the army, the brigadier-general of France, ever devoted, and so cruelly bereaved of late by the tragic death of his nephew in the same mountains—both from the first bore the Alpines witness of their fraternal solicitude and gave them the comfort of their affection.

A COMPANY OF ALPINE SOLDIERS OVERCOME BY AN AVALANCHE.

Publicity has already been given to the admirable discourse of the eventual chief of the Alpine army—the eminent General Zédé—a leader of men, animated, in his hard task, with an indefatigable spirit of justice and kindness. This excellent chief, who by his own wish presided at the obsequies of the victims of the disaster, paid tribute to those soldiers of France who fell so gallantly with a simple, manly eloquence showing deep feeling.

General Zédé, in his discourse, spoke of the various incidents of the accident, and was right when he said that no human prudence could have foreseen or prevented the catastrophe.

Too many people, on the strength of most condemnable assertions, are inclined to think that our mountain troops play with danger at their pleasure; that certain chiefs, with an exaggerated ardor, do not consider the men, and, with a light heart, confront useless perils in order to distinguish themselves.

Nothing could be more false. Of no other part of the army, if not of the Alpines, can it be truly said that prudence is the rule of all maneuvers, and the welfare of the soldiers the concern of the officers.

But the mountain, like the sea, has inevitable dangers which the soldier who faces them can no more ignore than the sailor ignores the menaces of wind and waves.

The tempest, the glacier, and the avalanche are the natural enemies of the Alpine soldier. He also has the pride of fighting in times of peace; he has the redoubtable honor of struggling with the elements. The mountain, like the sea, only reveals itself to men with stout hearts; but it has, like the sea, violent and sudden revolts, with which human science and wisdom are unable to cope. Must we recoil from its anger and become masters of the waves where we cannot conquer the ground? Can we deprive ourselves of this other school of force, virility and heroism—the mountain—and be contented with the ocean alone? If we should permit such slackness, we should no longer be worthy to occupy the land of our fathers. We do not pay too dearly in the lives that it costs us for the lessons taught us by the sea and the mountain, one or the other of which renews in us the forces of physical energy and life, far away from the cities where the force and life of a nation wane.

To comprehend these truths one must know our maritime and mountainous frontiers and the people who inhabit them. Consider the mountaineers only, for instance, and judge whether they have not purer blood, a more tenacious spirit, and riper judgment than the people of the plains. They are more masters of their hearts in times of peril. Our Alpines are besides superior to the best soldiers of the low countries. They have greater valor, which they owe to the mountains where, for the most part, they are born.

The guards of the Alps are recruited in Corsica, in Auvergne, in the Vosges, and finally in all the French territory commanded by Mont Blanc. Mustered into service in the neighborhod of this giant [Mont Blanc], "that a hundred mountains surround with their chain," they follow their hard and captivating calling, which makes them the picked of the brave.

No military school is worth these massive piles of rock before which, says Jomini, "the traveler stops, terrified." The boldest can scarcely conceive that men can make armies cross these barriers which nature seems to have created to set a limit to their cupidity and ambition.

Jomini died in 1869. He did not see the Italians establish themselves before us on the crest of the Alps and troops maneuver and live on the summits heretofore only scaled in passing by a Hannibal or a Napoleon.

We soon followed the example set by the Italians, and it is not for us to say whether our Alpines are better than their mountain guardsmen. While waiting for this question to be answered the two fraternize voluntarily on these sovereign heights. They reciprocate in their esteem for each other, for they court danger for the same cause. The Italians guard their frontier and we guard ours, while Mont Blanc rears his high pinnacle equally between them and becomes a perpetual reminder of the smallness and powerlessness of man beside the gigantic works of nature.—Le Monde Illustré.

THE HISTORY OF MEXICAN MINING.

WHEN Cortez, the Spanish pirate and adventurer, came to Yucatan in the dawn of the sixteenth century, and from there passed on up into Mexico, he found the Mexican mines comparatively little worked. The story of his perfidious conduct and the desolation which he wrought, overthrowing the empire of Montezuma, are very generally known, but the fact that he captured an entire tribe of Indians in the interior and worked the Mexican mines by slave labor is not so widely understood. It is a matter of history that at one time in particular the corpses of the Indian laborers were so thick during Cortez's administration that it was possible to walk all around the workings, and for a considerable distance along the highways on either side, without touching the ground.

After such widespread disaster it took Mexico a long time to get back on her feet, and it was not until 1821, when independence was declared, that the country really received any actual benefit of the mines, as previous to that the majority of the gold and silver had been sent back to Spain for the home government. With the declaration of independence, however, conditions improved, and since that time the stagnation which formerly characterized Mexican mining methods has been done away with, and at the present day, under the active and judicious administration of the President, General Porfirio Diaz, the progress has become accelerated, production has very materially increased, conditions in the mines themselves have been better, and a generally satisfactory activity is being manifested. The magnificent statesmanship which has enabled this one man to control absolutely the destinies of his nation and leave an indelible impress on the minds of others besides his compatriots is the subject of universal admiration. General Diaz has enabled Mexico to step into the forefront.

While Mexico's mining history is not more unusual than that of some other countries, so far as conquest and slavery are concerned, there is great credit due to the Mexicans for shaking off the lethargy which was upon them and joining actively in developing the resources of their country, whose magnificent richness in gold, silver, onyx, marbles, and other valuable minerals has been the wonder and envy of the world.—Mining and Metallurgy.

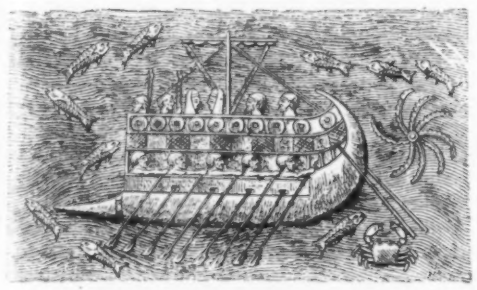
[Continued from SUPPLEMENT No. 1370, page 21954.]

FROM RAFT TO STEAMSHIP.

By RANDOLPH I. GEARE.

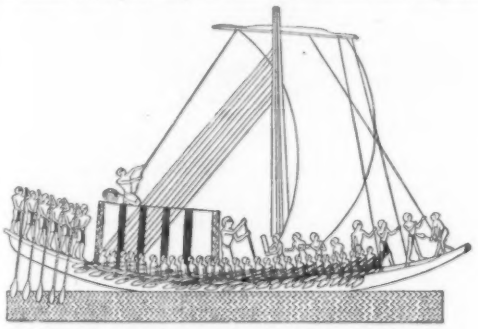
PART II.—ANCIENT AND MEDIÆVAL SHIPS.

WHILE the natives of this and other countries widely separated were still using such rude forms of craft



PHŒNICIAN WAR GALLEY.

as have been described, boats capable of carrying a thousand persons had long been in use in other parts of the world. It is generally conceded that the honor of active maritime enterprise belongs to the Phœnicians. Representations of Egyptian vessels, however, have been found of a much earlier age, dating back apparently to a period little short of 3,000 B. C. Some of these were probably of considerable size and capable



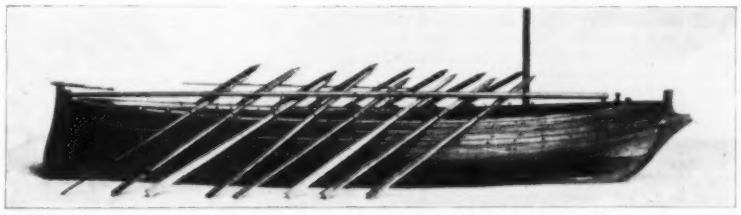
LARGE BOAT OF THE TIME OF THE OLD EMPIRE.

of accommodating a large number of rowers. An Egyptian monument, attributed to a period between 2000 and 2800 B. C., represents a vessel pulled by forty oars. It had a double mast made of two spars, and a large square sail bent to a yard and managed by sheets and braces. These masts, like those in the canoes of Ecuador, were "stepped" apart but, leaning toward each other, were fastened at the point where they met. At the bow the stem rose sometimes perpendicularly, forming a kind of forecastle, sometimes to curve backward and then forward again like a neck, which was usually finished into a figurehead representing some bird or beast or Egyptian deity. On the war galleys was frequently a projecting bow with a metal head attached, but well above the water. This was used no doubt as a ram.

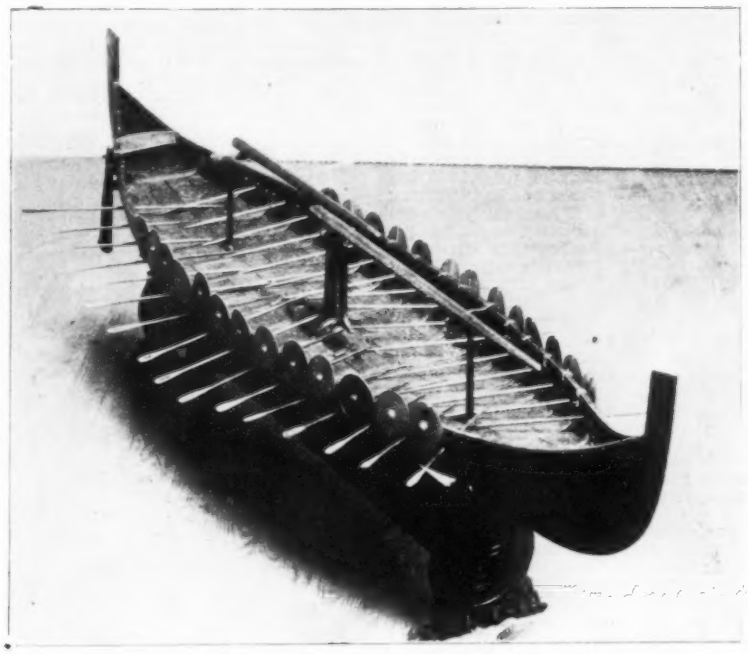
The double mast of the earlier period seems in time to have given place to a single mast furnished with bars or rollers at the upper part, for the purpose apparently or raising or lowering the yard according to the amount of sail required.

In some ancient galleys the sail had a bottom as well as a top yard. In the war galleys the sail is often shown rolled up, like a curtain, with loops to the upper yard. The steering was effected by paddles, sometimes four or five in number, but generally by one or two fastened either at the end of the stern or at the side, and above attached to an upright post in such a way as to allow the paddle to be worked by a tiller.

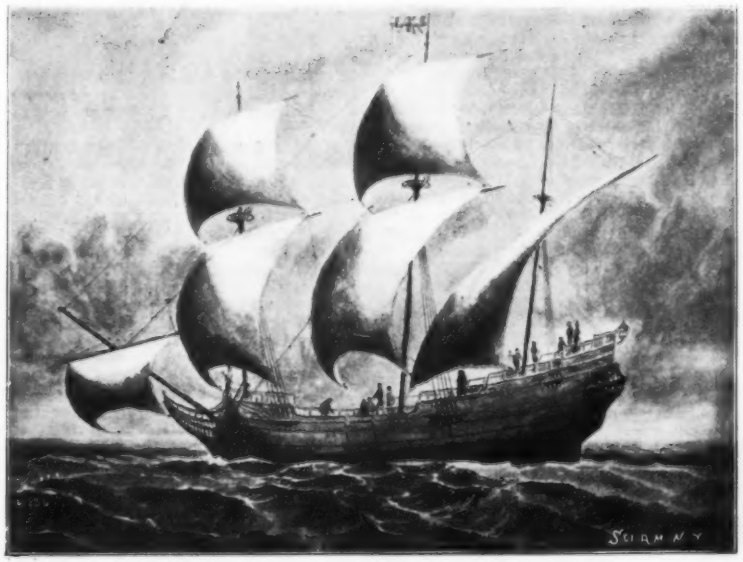
The Egyptian type of vessel discloses a ship proper, as distinct from a large canoe or boat, and *is the earliest ship of which there is any authentic record.* The tomb-paintings furnish most of our knowledge of the Egyptian ship, and in a good many records it is evident that vessels of that type were of that early period in



SIXTEEN OARED MEDIÆVAL BOAT.



A VIKING SHIP.



THE "MAYFLOWER."

represented on the walls of the palaces unearthed in Assyrian exploration.

The Phœnicians at an early date, perhaps about 1500 B. C., had constructed merchant vessels capable of carrying large cargoes and of traversing the length and breadth of the Mediterranean, and perhaps even of sailing around Africa. It was probably this same people that invented "biremes" and "triremes"—vessels provided with two and three banks of oars respectively, by means of which increased power and greater speed were attained without materially increasing the length of the vessel. The trireme became the Greek ship of war about 700 B. C. The first one is said to have been built by Aminocles at Athens. They were from one hundred and fifty to one hundred and sixty-eight feet long, and from twenty to twenty-five feet wide. They were flat-floored and of light draft. There can be no doubt whatever that the maritime enterprise of the Phœnicians had a marked influence on the ancient inhabitants of Scandinavia in the construction of their vessels. In the Norse vessel, too, is seen practically the same type as exemplified in the Greek galley.

The earliest form of "rig" was about the same the world over. There is therefore but little material difference to be found in this respect between the vessels constructed by the Egyptians, Phœnicians, Greeks and Norsemen. It consisted chiefly of one mast set nearly in the center of the keel line, and one square sail.

A peculiar feature of all ancient warships is that their sides were not parallel amidships, but slightly bulged forward, although they were vertically perpendicular. They do not appear to have had full decks, although partial decks were constructed in the bow and the stern. The midship was open, perhaps to accommodate the mast, which was taken down before battle. Even the Roman vessels in the time of Cæsar were not completely decked over. The main object in ancient naval warfare was to ram the enemy's ship and to endeavor to dislocate his oars. To do this, the oars of the attacking ship had to be drawn in so as to prevent them also from being broken. Vessels of that period were not covered with metal, but were calked and coated with pitch and tar, and were usually painted in the bow.

Mediæval Ships.—Transition from the ancient ship to the mediæval galley is not easily traceable. The sailing vessels of the time of the early Roman Empire, such as that in which St. Paul was shipwrecked, superseded the long low galleys propelled by oars. The battle of Actium is said to have dealt the deathblow to the ancient type of vessel with its many banks of oars.

The Saxons, who at one period assumed maritime

supremacy in the northern seas, are said to have possessed considerable skill in sailing "by the wind." Their apparently frail vessels were built of willow on a keel made of oak and were covered with skins. It is recorded that in the fifth century A. D., three Saxon vessels landed Hengist and Horsa on the southeast coast of Albion, each carrying three hundred men, and decked with high forecastle and quarter-deck—evidence indeed of remarkable progression in the art of shipbuilding.

In naval construction after the ninth century there is much obscurity till the eleventh and twelfth centuries, when the features of the mediæval galley began to be plainly visible. This was essentially a one-banked vessel. The use of the long oar or sweep took the place of the long paddling oars of the ancient vessel. The increased length of oar led to the employment of more than one man to the oar. Then the necessity arose of placing the fulcrum at a greater distance from the force that moved the lever. This was gained by the invention of the *apostis*. Upon the hull of the mediæval galley was laid a framework which stood out on either side from it, thus providing a strong external timber, running parallel to the axis of the vessel, in which the thwarts were fixed, and against which the oars were rowed. This arrangement gave a greater length inboard for the oars as compared with that of the ancient vessels. On the inner side, inclining upward, were benches for the rowers, arranged *à la scaloccia*, who could each grasp the handle of the oar, moving forward as they depressed it for the "feather," and backward for the stroke as they raised their hands for the immersion of the blade. The stroke was slower than that of the ancient galleys, but much more powerful.

In a work on naval architecture published in the sixteenth century it is stated that several hundred years earlier there had been constructed a warship propelled by paddles, the motive power being supplied by oxen. While the idea of using steam for driving vessels had, so far as we know, never been thought of at that time, it is not impossible that this curious craft may have suggested possibilities which after a long interval culminated in the use of steam for the same purpose. The oxen worked in pairs, walking round a vertical spindle or capstan, and pushing against a kind of capstan-bar. These spindles were doubtless connected by suitable gearing to the paddle-wheels beneath. Sails were also provided and heavy tackles for hoisting them. Arranged in a vertical position aft were the pikes, ready for instant use. There was also a powerful steering-oar and an overhanging bridge, or "sponson," from which the captain could con the ship. The bow was highly decorated with scrollwork and a figurehead representing some kind of animal, while below, near the water, was sculptured the head of some large bird.

Early pictorial illustrations therefore are not wanting to show that the Romans employed oxen to turn the paddlewheels, and in some ancient manuscripts in the National Library of France it is recorded that the boats in which the Roman army under Claudius Caudex was transported into Sicily were propelled in this fasion.

Although chronologically out of its sequence, mention may here be made of a curious form of boat, which has been called the "treadmill" boat, the motive power of which was furnished by horses. This was introduced either late in the eighteenth or early in the nineteenth century. It was, however, rather a reproduction of an old idea, as the foregoing paragraphs indicate, than an original invention.

Returning again to the advent of the Saxon vessel on the coast of England, we are brought to the time of the first English ship, the type of which was the same as that of the ancient Greek and similar to that of the Norseman. First it possessed but a single mast and a square sail, but it was not long before the more general use of sails was adopted. It is said that the Genoese were the first to entirely discard oars in seagoing vessels. At any rate, many such ships were found in England in the thirteenth century, toward the end of which the type of sailing vessel known as the "cog" came into use in Britain. These were swift sailing craft of about two hundred and fifty tons, and provided with two or three masts. The forward mast was raked away forward and was practically a bowsprit, though very much more upright than in any modern vessel.

(To be continued.)

SOME UNSOLVED QUESTIONS OF ORE TREATMENT.

IT is a sufficiently familiar fact to practical millmen in many departments of ore handling that there are certain troublesome features in the treatment of metallic ores which even the elaborations and refinements of modern times have not yet been able to extinguish finally. The object of this notice is to draw attention to a few natural causes which may not be fully realized by those who, having been trained in certain methods, are naturally predisposed to regard them as essentially right in principle. The particular details to be referred to are necessarily of a somewhat detached character, but will be arranged as far as possible in the order followed by the operations in which they arise, i. e., from the first rough crushing up to the final reduction to bullion.

No one who has had occasion to extend his observations over considerable tracts of mining country in various regions can have failed to note with regret the numberless instances of abandoned mills, silently recording the futile expenditure of hundreds of thousands of dollars, and only explained by the oft-told story, "It didn't treat the ore properly." Not even has a certain amount of preliminary care in mill sampling and chemical testing been always of avail to avert these misfortunes. In many cases the mill manager was supposedly inexperienced, or otherwise inefficient, and after he had made one failure of it, other first-class men did not care to risk identifying themselves with a second. And so the financial stream which primarily kept the wheels turning was dried up at the source, as it too often is.

Nobody needs to be told that a millman with a reputation for success never has to seek a job. But it is not every one who takes the trouble to ascertain clearly on what that reputation actually stands. Many people will tell you it is "luck," and doubtless that is an element in milling as in all operations connected with mining. But, however inconsistent it may sound with a work-a-day business, it may be observed that the successful millman is usually one possessing somewhat of a sympathetic and imaginative turn of mind. That is not to say that he might have cut a better figure as a poet or musician; nevertheless, he is so far gifted with the artistic faculty that he can picture on his mental tablet some of those actions of nature, which, not being immediately obvious to the eye, are likely to escape the notice of one who has been taught to work by rule. Hence, his experience is used with greater freedom, and his capacity of experiment is not hidebound by preconceived ideas.—Mines and Minerals, for March, 1902.

STEEL HIGHWAYS.*

THE weak spot in the armor of American civilization is the condition of our highways. In this regard we are behind the Ancient Romans and the prehistoric Peruvians. Careful investigation shows that we bear a burden in bad roads greater than the entire taxation of the most tax-ridden nation in the world.

The Chamber of Commerce of New York says that "the products of the United States are handicapped in all the markets of the world by a needless cost in primary transportation, which goes far to offset the vast advantages we possess in production and general transportation."

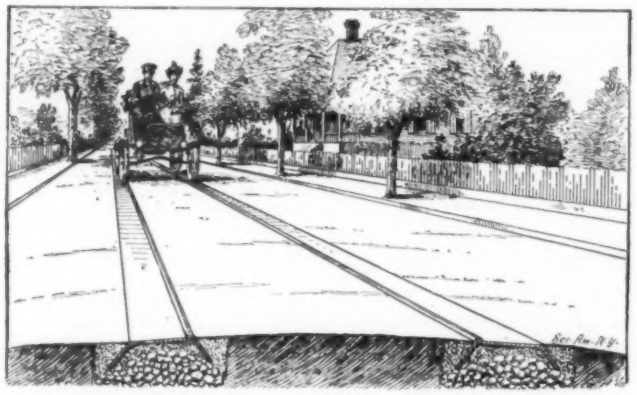
RESULTS OF THE CAMPAIGN FOR "GOOD ROADS."

We have made a ten years' campaign for "Good Roads," with small results, except to show the difficulties that lie in the way. *It is the chief defect in self-government that it will not make present sacrifices to secure future benefits.*

Our campaign has demonstrated that a people *who govern themselves will not, as a rule, tax themselves to build roads they know they need;* nor will they tax their children's children by borrowing the money to build roads, though they will transmit to those children not only the roads themselves, but the savings made by generations in using them.

In view of these facts we shall evidently make slow progress in road improvement in the United States unless we discover some new inducement to speedy action.

If we could find a method of road construction that



AUTOMOBILE STEEL ROADWAY.

is cheaper, and yet incomparably better, than any we have contemplated, we might arouse a new interest and desire and even a national enthusiasm on the subject.

If such new method of construction would speedily put us in respect to roads as far ahead of Europe as we are now behind, the pride and ambition of the country might be stirred to accomplish that result.

STONE ROADS.

One drawback to road improvement as it is generally understood, that is, macadamizing, is that it is a crude and unsatisfactory improvement at best; it shows no advance in method in the past two thousand years; and when compared with the high development of railroads it discredits the ingenuity of a progressive age and the talent that has been applied to the subject.

From a logical standpoint there is no more sense in running a wagon over stones than in doing the same with a locomotive. But railroads are a private concern and have had the advantage of a private interest and private initiative, while roads are a public concern and a public neglect. The same means of "smoothing the way" are available to both, but for roads it has scarcely been considered.

EXPERIMENTS IN STEEL ROADS.

The reasonableness of metal tracks for wagons has, however, forced itself into view from time to time; and some fifty years ago in Glasgow, Scotland, plates of iron were laid down for wheelways, following the idea of many roads in Italy and elsewhere made of stone slabs laid end to end. This was found highly satisfactory as to saving in haulage; but only very short plates were available, which required elaborate foundation and fastening; the price of the metal was high, and horses slipped and fell on the smooth surface. These difficulties led to the abandonment of the plan, but since then many short lines of iron or steel tracks have been laid in private establishments with complete satisfaction.

I had strong hopes of introducing steel trackways for trucks in certain streets of this city a dozen years ago, having made provision against the slipping of horses; and I had the strong support of Mayor Hewitt and President Van Rensselaer, of the Board of Aldermen, but the majority of the Board had other views.

Subsequently, when in charge of the government Bureau of Roads at Washington, I constantly advocated the testing of this improvement at the public expense, and my successor was enabled to lay several experimental sections of steel trackway, although he was at a disadvantage in not having means to pay for the rolls needed to produce the desired shapes of rail.

These experiments fully established the advantages of the system; and they were confirmed by private trials.

Mr. F. Melber, a well-known engineer of Pittsburg, says he "made twenty trials, using a spring balance to measure the traction, and found that the average force required to move a ton, on a level steel track, on a common wagon, was 3¼ pounds, or one-twelfth of the power required on a good macadam road."

Mr. Abel Bliss, of Chicago, laid down a short distance of light rail on a bad dirt road near New Lenox, Ill. I visited this road at the close of a hard winter, and found it in good condition after constant use by all kinds of vehicles, including traction engines.

But, strange to say, we have to go to Spain for the most decisive progress in this direction. A Consular Report, published in the Railroad Gazette of November 24, 1899, says:

"The road between Valencia and Grao is two miles in length, and an average of 3,200 vehicles pass over it daily. Until 1892 it was constructed of flint stone. The annual cost of keeping it in repair was about $5,470. The construction of a steel roadway was determined on, and the annual cost of keeping in repair the central belt of road thus relieved from heavy traffic—which proceeds over the steel rails—is now about $380. The total cost of the road laid was $9,506. The expense in detail was: Steel, $6,890; transportation and laying steel, $507; binding stone construction, $2,109; total, $9,506. The rails, during the seven years they have been in position, have not required repairing. At each side of the rail are layers of binding stones, the paved road being higher than the face of the rails. A toll of (about) eight-tenths of a cent is charged each vehicle passing over this roadway."

OBJECTIONS.

In addition to the slipping of horses it has been found in practice that a rut is liable to form alongside the rail, making it difficult for a wagon wheel to mount or remount the rail. This, however, is easily met by notching the outer edge of the rail in rolling it, and by putting the raised rib on the inner side of the rail and notching that also, and turning the metal from the notches outward, thus forming projections which lift the wheel into the rail; it may be further guarded against by having "remounting fishplates" at all rail joints. The notched rib on the inside also prevents horses from slipping, and as a farther protection small depressions can be rolled in the general surface of the plate. These will be useful also in preventing the wheels of automobiles from slipping when climbing hills.

CONSTRUCTION.

The studies of engineers, and the experiments so far made, tend to simplify the construction of these roads, and especially their foundations, to the last degree.

It is found needless to tie the rails together or to use cross ties or other supporting devices. The rail is a simple channel with flaring sides about six inches wide turned down into a narrow bed of gravel, broken stone or vitrified clay, which is drained at every low point; the rails are strongly spliced by a channel piece, closely fitting underneath the joint; the whole forming practically a *continuous plate on a uniform bearing.* The space between the rails is covered with a light coat of gravel; on the outside the earth is simply rolled.

A single track will serve for most country roads; the turning out is easy, and the earth road never being used is not cut up and never muddy except when frost is coming out.

DURABILITY.

This point is, of course, least well determined, but the known facts are highly satisfactory. The Valencia road with its enormous traffic shows wear at the rate of only about 1-10 of an inch in 33 years.

The plates laid on Jones' Bridge at St. Johns in the Province of Quebec, about 1858, were reported in 1896 to be practically the same as when laid, though the traffic at times has been heavy.

It appears, therefore, that the generation which lays down these roads will not be called upon to renew them.

COMPARATIVE COST.

The amount of metal required, if the plates are 12 inches wide and ¼ inch thick, and including splices and belts, is nearly 75 net tons per mile of single track. An average price of steel of late years is per-

* Remarks of General Roy Stone before the Automobile Club of America, March 4, 1902.

haps one cent per pound; and at this price the percentage of profit is still very large, so that it may be safe to assume $20 per ton as a future price of the metal.

At this rate the steel roads will not cost more originally than stone roads do on the average, and the expense of repairs will be practically nothing for a lifetime. (The repairs at Valencia are on the "binding stones," which we should not use.)

ADVANTAGES.

Aside from the reduced cost of hauling and the saving in wear and tear of vehicles, the great advantage to automobiles will be in extending their radius of action without recharging or resupply. The same power that now carries the machine 50 miles on a stone road in a level country will carry it probably 200 miles on a steel track.

OPPORTUNITY OF AUTOMOBILISTS.

The intelligence of this association will apprehend at once the opportunity which is here offered them to serve the public as well as their own interests. If the Automobile Club can identify itself with the introduction of a new highway system which settles the great "road problem," that has so long agitated and troubled the country, and settles it in a manner which pleases every one concerned, farmer, teamster, bicyclist and pleasure driver, it will merit and receive the plaudits of the public and its path will be made easy in the halls of legislation.

The services of the club will be especially useful in persuading some one of the steel companies to incommode itself with the rolling of special rails while overwhelmed with its regular business, and inducing the road authorities to order a section of steel road laid in some good locality like the suburban districts of New York; what further assistance the club can render time will develop.

THE ELECTRIC LINE FROM THE INVALIDES TO VERSAILLES.

THE Saint Lazare and Mont Parnasse stations serve as starting points for the numerous suburban trains of the Company of the West, for the trains of Normandy and Brittany, and for the trains of the State railways. It was principally with a view to relieving both of them that the new station under the Esplanade des Invalides was established. This is going to be connected with Versailles by a new line, of which a portion was opened to exploitation on the first of July.

This line is conceived according to strictly modern data, and its construction, as well as the adoption of electricity for the propulsion of the trains, renders the study of it especially interesting.

The portion comprised between the Invalides and the Champ de Mars was opened for the Universal Exposition. It is established beneath the public road on the bank of the Seine. Beyond the Champ de Mars the line uses the tracks that previously existed as far as to a point a little beyond the viaduct of Point-du-Jour, and then deviates from the Seine.

Between the ground of the station of the Invalides and Versailles the difference of level is about 325 feet. The slope in several places is 0.13 of an inch to the foot. Starting from the place where it leaves the banks of the Seine, the track constantly ascends. It rises first up to the declivities of Issy, and then enters the valley of Meudon, where it passes under the viaduct of the Paris-Montparnasse and Versailles railway. Between the fortifications and the station of Meudon-Val-Fleury, say for a length of 2.5 miles, the difference of level is more than 110 feet. This portion of the line comprises five very large masonry viaducts, the most important of which is 1,814 feet in length.

The line immediately beyond the Meudon-Val-Fleury station enters a tunnel, from which it emerges at Chaville to joint the line of the Montparnasse station. The tunnel is about two miles in length, and the difference of altitude between the extremities is about 56 feet.

The line ends at the Versailles station on the left bank.

We have said that the trains that will run from the Invalides to Versailles will be electric. The reason is that although at the present time there is a tendency toward the adoption of electricity for certain suburban lines, and especially for those that present heavy gradients, the special conditions of the new line rendered the use of it almost imperative. Between the Invalides and the Champ de Mars it was very important to follow the example set by the Company of Orleans in order not to pollute and blacken the tunnels and stations. On the other hand, the Meudon tunnel, which has a continuous gradient of 0.01 of an inch to the foot, is built in a very unfavorable manner. By reason of its length, the ventilation would present very great difficulties were steam locomotives employed.

The Railway Company of the West has therefore established works upon the banks of the Seine, near the Issy-les-Moulineaux station, for the production of electric energy, and designed to supply the trains doing service between the Invalides and Versailles.

The current produced must be utilized also for other purposes. It is with it that will be lighted all the stations of the line and likewise the stations of the line from the Champ de Mars to Courcelles-Levallois. It is also this current that will actuate the drain pumps necessary for the part of the line situated below the level of the high waters of the Seine. Finally, the same current will furnish the motive power for the operations of loading and unloading at the stations.

Moreover, the company has constructed compressed air engines for switching at the Invalides station, and for aid upon the line, especially in the tunnel in case of accidents. The air is compressed by electric apparatus in reservoirs, whence the engines are charged.

The new line therefore gives a striking example of a few of the advantages of the applications of electricity. Frequent trains will pass for a length of about eleven miles; its stations will be lighted and the loading and unloading thereat will be mechanically effected; pumps will exhaust the water, apparatus will compress the air, and it is at one point only that steam engines will produce all the energy necessary for these various services.

The power of the Issy works is 9,000 kilowatts. Twenty-seven boilers furnish the steam to nine horizontal Corliss engines, each of which drives one dynamo. The current produced is a triphased one of 5,000 volts. It is transmitted by subterranean cables to substations. The substations designed for the propulsion current are three in number, and their sites have been selected in such a way that the charge may be distributed as uniformly as possible.

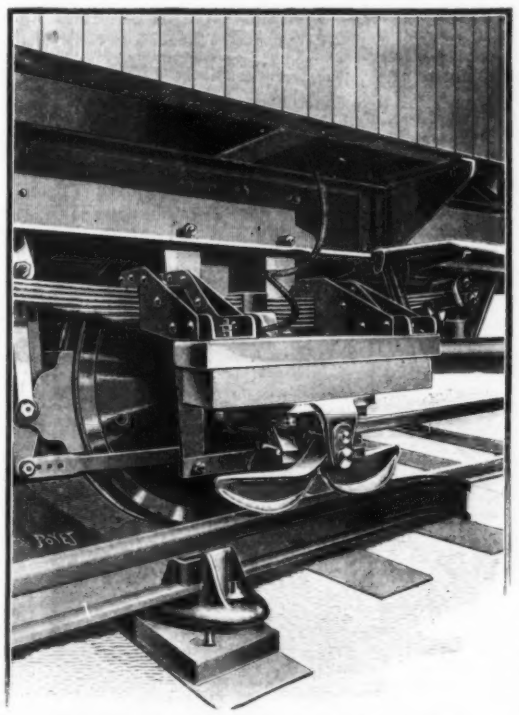
The triple-phase current of 5,000 volts is transformed therein into a continuous one of 550 volts, which is sent into the insulated electric rail placed at the side of the track.

As shown in the cut, this rail is arranged slightly above the level of the track rails, and rests upon insulated supports. At its extremities it inclines toward the ground in order that the shoes of the trains may form a contact without striking against the extremity of the electric rail. It is by means of these shoes that the motors of the trains are supplied. Our engraving shows the arrangement of the last shoe adopted by the Railway Company of the West. It consists of two parts, which a spring tends to bring together and press against the rail.

The line from the Invalides to Versailles is nearly completed. It merely remains to finish a portion of the great tunnel, the construction of which has been rendered very difficult through the presence of strata of quicksand.

Electric trains are at present running from the Invalides to Meudon. The Railway Company of the West possesses a certain number of electric locomotives that are designed especially for hauling the trains of the large lines as far as to Versailles, where steam locomotives will take their place.

For suburban service from the Invalides to Meudon,



EXTERNAL RAIL AND CONTACT SHOE.

the company employs the automotor trains which, during the Exposition, did service between the Invalides and the Champ de Mars. They have a motor car at the head and another at the rear.

Concurrently with these light trains the Railway Company of the West is putting in service the Sprague automotor train of variable length, made up of six cars, two of which are motor ones, or of nine cars, three of which are automotor, according to the traffic.

Finally, the Thomson-Houston Company likewise is to establish an automotor electric train having a motor carriage at the head and another at the rear. —For the above particulars and the illustrations, we are indebted to La Nature.

CONTEMPORARY ELECTRICAL SCIENCE.*

TRANSFER OF RADIO-ACTIVITY.—One of the most interesting properties of the radio-active substances thorium and radium is their power of communicating a secondary radio-activity to all bodies in their neighborhood. If a wire possessing a strong negative charge is introduced into a closed metallic vessel containing thorium or radium, the secondary radio-activity is entirely confined to the wire. But if the wire is positively charged it remains negative, and the secondary radio-activity appears on the walls. The active rays of thorium and radium behave in every way like radio-active gases or vapors. They are rapidly diffused through gases, through porous substances like cardboard, and, in distinction from the gaseous ions which they generate, they are able to pass through cotton wool plugs and through solutions without being absorbed. E. Rutherford is of the opinion that the carriers concerned in the transfer of radio-activity are positive ions. He measures the velocity of the carriers with the aid of an alternating electric field and shows that their velocity is practically the same as the velocity of the positive ions. That the ions are positive is proved by the fact that they follow the potential gradient from a higher to a lower potential. The amount of secondary radio-activity is quite independent of the chemical nature of the body upon which the radio-active ions are deposited. The deposits may even be chemically separated from the surface and condensed by evaporation.—E. Rutherford, Physikal Zeitschr., February 15, 1902.

PRESSURE EXERCISED BY LIGHT.—Peter Lebedew has succeeded in demonstrating both qualitatively and quantitatively, the pressure exercised by light, which is postulated by Maxwell's theory. The obstacles hitherto met with were the radiometer action, which is thousands of times stronger than the action sought for, and the disturbing effect of convection. The author eliminated the latter by reversing the illumination repeatedly, and the former by high exhaustion, a large bulb, and the exclusion of rays capable of heating the walls of the bulb. To facilitate a rapid equalization of heat in the radiometer vanes, he made them of very thin aluminium foil, suspended torsionally by a glass thread arranged as in the Cardani suspension. The light used was that of an arc lamp, and its incident energy was determined calorimetrically. The surfaces of the radiometer vanes, which was either plain or blackened, were tested with regard to their reflecting powers. The absolute error of the aggregate measurements was 20 per cent. The results agree with the theoretical values of Maxwell and Bartoli within 10 per cent. The pressure is directly proportional to the energy of the incident light, and independent of its color.—P. Lebedew, Ann. der Physik, No. 11.

VISIBLE MAGNETIC TUBES OF FORCE.—M. Pellat describes an interesting arrangement in which cathode rays are made to trace out exactly the course of a magnetic tube of force in a vacuum tube brought into a magnetic field. He finds that at certain pressures, and at certain high intensities of the magnetic field, the bundle of cathode rays issuing from a plane cathode takes the shape of the tube of force having the cathode for its cross-section. The tube of force is thus traced through the tube along its whole extent, since the luminosity, due to cathode or canal rays, proceeds from the cathode in both directions. The author points out that the cathode rays concerned in this phenomenon are different from those which undergo the ordinary magnetic deflection. He calls the former "flux A" and the latter "flux B." Flux A always proceeds from the cathode in the direction of the lines of force, whether those lines be normal, oblique, or tangential to the surface of the cathode. It follows that the flux A is altogether independent of the sense of the field. This is not the case with the flux B, or the anode rays. The pressures within which the above phenomenon is observed range from 4 mm. to 0.004 mm. of mercury. The best display is obtained with the pressure of 0.5 mm. and a field of 3,000 units. A spectroscopic analysis of the violet rays concerned in the phenomenon shows only lines due to air, and none due to aluminium or its impurities.—H. Pellat, Comptes Rendus, February 10, 1902.

GALVANOMETRIC OBSERVATIONS OF THUNDERSTORMS.—The observation of distant thunderstorms has been lately carried out by various electrical methods. Tommasina used the electro-radiophone, Fenyi used a coherer, and now J. J. Landerer has devised an apparatus consisting of a telegraphic line 300 yards long, running in a N. N. E. direction, put to earth through the water-pipes of Tortosa, and joined to a galvanometer showing the ten-millionth of an ampere. This method of observation has the great advantage of showing the direction of the discharge. It was found that when the lightning flashes over the distant mountains the spot of light undergoes a double shock. The first shock has a small amplitude, and the second shock is in the opposite direction and has a large amplitude. The author has observed that during the same storm the small deviations are always in the same direction, the discharge proceeding from north to south in the case of storms taking place east of the meridian, and from south to north in the case of storms in the west. Hence the direction of these deflections enables the observer to a certain extent to locate the storm, and this is especially useful in the daytime, when the light of distant lightning flashes is not easily perceived. A telephone introduced into the circuit gives a noise somewhat resembling the well-known crepitation of tin, but, of course, without giving any indication of the direction. As regards the distance within which storms can be recorded by this method, the author mentions having recorded a storm over Majorca, 150 miles from Tortosa.—J. J. Landerer, Comptes Rendus, February 3, 1902.

DISCHARGE FROM GLOWING PLATINUM.—The fact that glowing bodies discharge positive and negative electricity with unequal facility has been shown by many observers. The most detailed examination of this subject has been made by Elster and Geitel. They found that when a platinum wire was heated to a bright red heat, in an atmosphere of air or oxygen, at low pressure a cold metal plate in its neighborhood discharged negative electricity more readily than positive. If, however, a thin platinum wire or carbon filament is heated in an atmosphere of hydrogen at low pressure, the cold plate discharges positive electricity more readily than negative. A very simple means of obtaining strong surface ionization is to heat a platinum wire or plate to red heat by an electric current, and this has been employed by E. Rutherford to test the validity of certain theoretical results when the ionization was confined mainly to the surface of one electrode. The author's theory indicates that the current between a positive platinum plate and another plate earthed through a galvanometer is independent of the intensity of the ionization—i. e., of the temperature of the plate beyond a certain limit in value. Also, that the current is directly proportional to the square of the voltage between the plates; that it is directly proportional to the velocity of the ions, and inversely as the cube of the distance between the plates. The results show that none of these conclusions are strictly correct, but this is mainly due to a failure in realizing the theoretical conditions. The current falls off more rapidly than the inverse cube of the distance, and this is due to the heating of the platinum plate. As regards the velocity of the

*Compiled by E. E. Fournier d'Albe in The Electrician.

ions, that of the positive ions may vary within wide limits, and it increases with an increase of temperature of the gas. The velocity of the ions deduced from measures of the limiting counterfeit does not necessarily represent the average velocity, and is much less than the maximum velocity.—E. Rutherford, Phys. Review, December, 1901.

A CLOISTER AT PALERMO.

Sicily is the land of ancient legends and admirable monuments of art. Guy de Maupassant somewhere calls it a "divine museum of architecture." Syracuse, Girgenti and Palermo, buried for centuries under fine ashes, preserve many curious remembrances of what constituted a goodly number of their charms. Here the Saracens, the Normans and the Spaniards have left traces of their domination almost everywhere. The companions of King Roger and the various conquerors of the "Pearl of the Mediterranean," as the poets of yore styled the charming and fertile island, have marked their passage further still at Palermo, the city of sacred statues, holy images and votive offerings, than at ancient Agrigentum, Girgenti or Syracuse. And it is with good reason that the people of Palermo are proud of their cathedral, the "Assunta," which is almost a mosque and is crowned at its summit by battlements and provided at its corners with slender belfries that have the counterfeit appearance of minarets; of the Santa Maria of Martorana; of the Palatine Chapel, a rich jewel set into the palace of the Norman kings, and in which the Gothic style is harmoniously combined with the Byzantine; and of other churches still that date from the twelfth century, such as San Giovanni dei Leprosi, San Spirito, the Incoronata, and San Giovanni degli Eremiti. It is the cloister of this latter that is illustrated in the accompanying engraving.

CLOISTER OF SAN GIOVANNI DEGLI EREMITI AT PALERMO.

A little more severe than the cloister of the ancient convent of Monreale (at a few miles from Palermo), a masterpiece of beauty and gracefulness, and a little more ascetic, the cloister of Saint John of the Hermits produces an equal sensation of art. Its columns are not sculptured in cable molding, nor are they surmounted with capitals that are all different; but they rise with exquisite delicacy, and inclose an abandoned court in which a luxurious vegetation runs riot, and in which grow spontaneously, glorious among the ruins, bulky plants along with wild flowers and grasses.

In the peacefulness of this cloister, filled with verdure, one's fancies wander. Men have here passed away; and here abbots and monks have meditated and prayed for their own salvation and that of their fellow creatures. They, too, have passed away, and their bodies have been committed to the earth. Who knows whether some of them are not sleeping in the shadow of these columns and arches under an indulgent sky? Perhaps it is from them that comes this confusion of rich florescence. After their death, nature resumed all her rights, and converted this court, in which they communed with their thoughts, and in which resounded their steps, into a magnificent garden of perpetual youth. For the engraving and the above particulars, we are indebted to Le Magasin Pittoresque.

Old rags soaked with turpentine and placed near mouse holes or stuffed into them completely drive away these animals. It is well, however, to renew the oil from time to time.

THE WATER OF THE DEAD SEA.*

By C. Ainsworth Mitchell, B.A., F.I.C.

There are few more interesting sites in the world than the large lake which receives the waters of the Jordan. Its historic interest, the marvelous legends which were accepted and passed on by mediæval travelers, its desolate position, and the remarkable character of its water have all helped to make it famous.

In the Bible it is called *The Salt Sea* and *The Sea of the Plain;* while among the Greeks and Romans it was known as *Lake Asphaltites*, from the bitumen found floating on its surface. Its more modern name of *Mare Mortuum* or *The Dead Sea* is due to the absence of life in its waters and the scanty vegetation on its shores. Among the Arabs it is still known as *Baheiret Lut* or *The Sea of Lot.*

In shape it is an irregular oblong figure somewhat resembling a bow, the general direction of which is from north to south. On the east and west it is inclosed by ranges of mountains, which in places rise in sheer precipices from the water to a height of over 2,000 feet. Josephus (Bell. Jud. IV., Ch. 8) gave its dimensions as 72 miles long by 18 miles wide, but explorations during the nineteenth century have shown that it is now only 46 miles in length by about 8 miles in width. Some contraction of the area has undoubtedly occurred, but even allowing for this, the earlier estimates must have been too great. The surface of the water is more than 1,300 feet below the level of the sea. The bottom is rocky and uneven, the northern part being very deep, while the southern section below the peninsula of Lisan seldom exceeds ten feet in depth.

The lake thus lies in a deep cavity, and being exposed to the burning rays of the sun, evaporation proceeds so rapidly as to more than counterbalance the influx of the Jordan. Incrustations of salts mark the higher levels reached by the water when the river is flooded.

To the southwest lies an extensive range of hills of rock salt, while sulphur mines are found on the west coast, and sulphur springs all along the shore. The origin of the asphalt which floats in masses on the water is attributed to the "slime pits" in the vale of Siddim (Gen. xiv., 10). This asphalt is driven by the wind to the western and southern shores, where it is still collected by the Arabs and sold for pitch and for medicinal purposes. According to tradition, it was used by the ancient Egyptians in embalming their dead.

The site of the cities of the plain has been placed by some in the northern, and by others in the southern part of the lake. Among the legends which were once commonly believed, was that the vestiges of Sodom and Gomorrah could be discerned centuries afterward. Thus Josephus writes: "The traces of the five cities are still to be seen, as well as the ashes growing in their fruits, which fruits have a color as if they were fit to be eaten; but if you pluck them with your hands they dissolve into smoke and ashes."

The marshes adjoining the sea are very unhealthy, and malaria and fever are prevalent among the few tribes which dwell near them. Several explorers have lost their lives from the results of exposure and fever.

The water in mass is bluish-green and resembles sea-water. All accounts from Strabo to the present day agree as to its great density. Pococke, who bathed in it in 1743, found he could lie upon the surface without sinking. This characteristic has been so exaggerated by the earlier travelers that legends have attributed miraculous properties to the water. For instance, Sir John Maundeville in his Travels, published between 1357 and 1371, wrote: "And neither Man, Beast, nor anything that beareth Life in him may die in that Sea. And that hath been proved many times by Men that have deserved to be dead, that have been cast therein and left there 3 Days or 4, and they might never die therein; for it receiveth no Thing within him that beareth Life. And no man may drink of the water for Bitterness. And if a Man cast Iron thereon it will float above. And if Men cast a Feather therein it will sink to the Bottom, and these be Things against Nature."

The first recorded analysis of the water was made in 1778 by Lavoisier by the then imperfect methods of analysis. He found it to contain 46.6 per cent of solid matter, consisting of 40 per cent of calcium and magnesium chlorides, and the remainder of common salt. Analyses have since then been made by Marcet in 1807, by Gay Lussac in 1818, and by T. and W. Herapath in 1850.

A specimen of the water, which I have recently analyzed, was brought home some years ago by Mr. Boyle, a descendant of Robert Boyle's brother. It was given to me by his daughter, Mrs. Keely, to whom I take the opportunity of expressing my best thanks.

It was a yellowish dirty-looking liquid with an extremely saline taste. Its specific gravity compared with distilled water at 60 deg. F. was 1.203, a result which agrees well with the figures obtained by Marcet (1.211) and by Lavoisier (1.2403). The variations being satisfactorily accounted for by the different periods and distances from the mouth of the Jordan at which the samples were taken.

It is thus one of the densest natural waters known, its specific gravity far exceeding that of sea-water, which only averages 1.027.

We may express these figures in other terms by saying that a gallon of distilled water weighs 10 pounds, a gallon of ordinary sea-water 10¼ pounds, and the same volume of Dead Sea water 12 pounds.

This accounts for the remarkable buoyant properties of the water, though obviously neither iron nor even aluminium with a specific gravity of only 2.6 would float upon it.

The great density of the water is due to the large quantity of saline matter in solution. The amount found by Lavoisier was doubtless considerably too high, for his analysis was made by the method of crystallization; and the results obtained by other chemists are in better agreement with the 24.46 per cent which I have found.

The accumulation of salt must be attributed to the ceaseless evaporation of water and continual introduction of fresh supplies charged with salts from the surrounding strata. In sea-water the total salts only average 3.5 per cent.

This excess of saline matter has a very unpleasant effect upon bathers, and, according to Legh, produces a sort of temporary blindness. On leaving the water the skin is rapidly covered with a thin crust of salt.

On igniting the residue left on evaporating the water it darkened, owing to the combustion of the organic matter. This was present in considerable quantity (about 0.5 per cent), and probably consisted of bituminous substances derived from the asphalt.

The chlorine amounted to 15.9 per cent, and in the residue was chiefly present in combination with magnesium, calcium, and sodium. The chief constituent of the water was thus magnesium chloride, which formed 9.06 per cent of the total solid matter. In sea-water this salt is present to the extent of about 3.7 parts per thousand.

By combining the amount of sodium (3.35 per cent) with its equivalent quantity of the chlorine, the amount of common salt in the water was calculated to be 8.52 per cent. It is thus much more than is present in sea-water, where it averages about 2.8 parts per cent. It is interesting to note, however, that whereas in sea-water the amount of ordinary salt is seven times that of the magnesium chloride, in the Dead Sea water they are present in approximately equal proportion. The calcium, which amounted to 1.3 per cent, was probably originally in combination with part of the chlorine, with the exception of a small quantity combined with the sulphuric acid as calcium sulphate or gypsum.

Bromine probably as magnesium bromide composed 0.24 per cent of the water, and potassium as potassium chloride 1.20 per cent. Small quantities of iron, aluminium, and silica were also identified.

The calculated composition of the solid constituents of the water, excluding the organic matter, was as follows:

	Per cent.
Magnesium chloride	9.06
Calcium chloride	3.49
Sodium chloride	8.52
Potassium chloride	2.37
Iron and aluminium chlorides	0.55
Calcium sulphate	0.148
Ammonium chloride	0.029
Silica	0.083
Magnesium bromide	0.21
Total	24.460

* Knowledge.

THE MANUFACTURE OF SULPHURIC ACID BY THE CONTACT PROCESS.

In an address before the German Chemical Society Knietsch has given an interesting account of the development of a method for the manufacture of sulphuric acid which is evidently destined to revolutionize this great industry in supplanting the use of the old lead-chamber method. Since 1831, when Phillips in England discovered the fact that sulphur dioxide and oxygen can be made to combine in contact with finely-divided platinum, many efforts have been made to apply this and other catalytic agents to the practical manufacture of sulphuric acid, but until within a few years the problem has remained unsolved. The suc-

cess of the process at the Badische Anilin- und Soda-Fabrik has been due to a long series of carefully conducted experiments. A serious obstacle encountered was the difficulty of properly purifying the gases from the pyrites furnaces so that they would not quickly destroy the activity of the platinum, which is used in the form of platinized asbestos. Traces of arsenic were found to be one of the chief causes of this trouble, and by proper cooling and washing, and by actually filtering the gases it was finally possible to remove all solid particles, so that the platinum remained effective for an unlimited time. It was found that a temperature of about 450 deg. C. is most favorable for the reaction, hence instead of heating the platinized asbestos, as was formerly thought necessary, it has been found desirable to cool it after the process has been started. The fact that the mass action of an excess of one of the reacting gases has an important influence upon the completeness of the reaction was discovered; hence the reaction is practically complete with the gases from pyrites burners containing about three time the necessary oxygen. The process is particularly adapted to the manufacture of fuming sulphuric acid and the anhydride, but there can be little doubt that it will be the method of the future for the production of the ordinary acid. The statement is made that the production of sulphuric anhydride by this process at the Badische works amounted to 116,000 tons in the year 1900. The address as published gives many valuable data in respect to the physical properties of all strengths of sulphuric acid, including the melting point, specific gravity, specific heat, heat of solution, electrical resistance, action on iron, boiling point, vapor pressure, viscosity and capillary action.

PERSEIDES—OBSERVATIONS OF M. FLAMMARION

M. CAMILLE FLAMMARION has lately made a report to the Académie des Sciences relative to the observations of the Perseides made in August of last year. He had previously made a series of observations in 1899 at the Observatory of Juvisy, but wished this time to make a more extensive study of the Perseides, and especially with a view of determining the heights of the meteors. Accordingly he established an auxiliary observing station near Juvisy, at Antony. The observations were made especially from the 11th to the 14th of August, which was the maximum epoch, by his aids, Messrs. Antoniadi, Blum, Chretien and others, joined by M. Libert of the Havre Observatory. A part of the observers were stationed at Juvisy and part at Antony, and it was especially desired to observe the brilliant meteors whose trail permitted an exact determination of their trajectory. During the nights of the 11-12, 12-13, 13-14 August there were registered in the two stations, as many as 283 trajectories. The meteors came from three principal radiating sources, of which the following are the co-ordinates:

Constellations.	A.R	D.
Perseus	47 deg.	+54 deg.
Cassiopeia	12 deg.	+55 deg.
Pegasus .....352 deg.		+15 deg.

The latter being the least active of the three. During one night, the 12th of August, the number of meteors per hour was noted as follows: From 12 P. M. to 1 A. M., 117 meteors; from 1 to 2, 35; from 2 to 3, 28; from 3 to 3.30, 23. The mean hourly number reached its maximum in the night of the 12-13th of August. These results are in accord with the observations of Messrs. Tarry and Péridier of the Société Astronomique. The reduction of the observations with the view of determining the altitudes of the meteors was carried out by M. Henri Chrétien, Secretary of the Meteor Commission of the Société Astronomique; they are the result of the comparison of the observations made at the two stations, which are 5.7 miles apart. The number of meteors registered in double is 21, due to 59 trajectories found at Juvisy and 44 at Antony during the same period. Out of the 21, 8 were considered sufficiently good to be calculated upon, and thus 16 per cent of the meteors observed could be surely identified. This excellent result is due to the nearness of the stations and the agreement which had been made to observe especially toward the zenith. The accompanying figure represents the 16 apparent trajectories grouped in pairs on the same chart, so as to render evident the effects of parallax. The full white lines represent the trajectories found at Juvisy, and the dotted lines those at Antony; the letters indicate those of each pair. The following table contains the data found for the 8 meteors considered in the present case:

Meteors.	Height of Appearing. Kilometers.	Height at Disappearing. Kilometers.	Height of Trajectory. Kilometers.
B	38	29	9.8
F	15	13	2.25
G	107	68	48
H	96	22	81
I	119	86	40
J	75	14	84
K	92	23	95
L	30	21	11

From this table it will be seen that the lowest meteor appeared at a height of 15 kilometers, while the highest appeared at a height of 119 kilometers.

BONE DUST IN THE ALIMENTATION OF YOUNG CATTLE.*

FOR three years we have endeavored to utilize the efficacious action exercised on nutrition by phosphoric acid, one of the most essential elements in the growth of young animals. We first experimented on sucking calves with this acid in various forms—bicalcic phosphate, precipitated tricalcic phosphate, glycero-phosphate from bone ash, and phosphates extracted from the flesh of animals.

We were satisfied from the experiments of our predecessors that nothing conclusive in favor of phosphoric acid would be derived from such experiments. Nature lavishes this acid in the maternal milk in a form so readily assimilable that the addition of phosphate, especially of mineral origin, is without marked effect. It was well, however, to confirm this as a point of departure.

When vegetable alimentation succeeds the lactic period the conditions are not the same.

A calf of average weight requires only 15 or 20 grammes of phosphoric acid a day for increase of a kilogramme in its weight for the same time. Now, when it has attained a weight of 100 kilogrammes it receives every day at least 30 grammes in the quantity of milk sufficient for its nourishment.

The animal of the same weight, completely weaned, finds with difficulty in the vegetables which compose its food from 10 to 20 grammes of the same acid per day, of which a material part has often a very moderate coefficient of digestibility. This comparative lack of one of the most important elements utilized in the growth of the body must apparently retard the growth. This fact we have endeavored to verify by ascertaining whether the addition of a phosphate to the food rich in all the other nutritive principles is capable of increasing the fixation of phosphoric acid in the tissues. If this increase is manifested it implies the utility of phosphates in the nourishment of young animals when otherwise not supplied with sufficient phosphoric acid.

For two years we have administered to animals just weaned phosphates of different kinds, principally the powder of green bones, which appears to us more active than all other phosphatic products.

The results have never varied. Every time that the subjects under observation have made rapid progress from rich and abundant nourishment this progress has been accelerated by the addition of 50 or 100 grammes of bone dust to the daily ration. The results were not conclusive when the animals were otherwise insufficiently nourished.

As the food must be the same during the period serving for comparison, that in which the calves received the bone dust, our investigations took place principally during the pleasant season and were necessarily shortened.

Notwithstanding this forced limitation, the results were so striking that we did not hesitate to undertake longer experiments. The elimination by the digestive tube is slow with ruminants; it was necessary to allow full time.

While the calf is receiving the milk diet the digested phosphoric acid not retained by the tissues passes into the urine; as soon as the animal receives pasture food only slight traces appear; all the phosphate that is not utilized by the organism then passes in the solid dejections.

To determine with certainty whether a part of the bone phosphate added to the nourishment of the subject was assimilated all the aliments were weighed carefully every day, and also the solid and liquid excrements. We likewise estimated daily the phosphoric acid contained in each. The first operation continued for 52 days.

The animal, a calf of the average weight of 163 kilogrammes, received in the course of the experiments in 24 days 511 grammes of phosphoric acid from bone dust. Its full aliment contained 1,090 grammes of the same acid. Of the 1,600 grammes, 567 were fixed. Its total weight was increased by 36 kilogrammes; that is, 1,500 grammes per day, and 15.74 grammes of phosphoric acid retained per kilogramme. For 24 days its food was exactly the same, the bone dust excepted. It furnished 1,064 grammes of phosphoric acid, of which the total amount fixed was only 392 grammes. The final increase was found reduced to 27 kilogrammes, representing an increase of weight of 1,125 grammes per day, and 14.53 grammes of phosphoric acid per kilogramme.

The proportion of phosphoric acid assimilated was essentially the same, whether it was furnished entirely by the vegetable food or a third of it from pulverized bones, 36.8 in the first case, and 35.4 in the second. It cannot therefore be denied that young animals when grazing are able to derive the same advantage from the phosphate contained in the bony tissue as from that found in their usual nourishment.

In support of the alleged advantage derived from the phosphate of bone dust it may be stated that the daily increase of the animal in weight passed from 1,125 grammes to 1,500 grammes. This result was the more satisfactory because the calf had not succeeded at any other period of its existence in gaining a weight of more than 1,200 grammes per day.

Notwithstanding our opinions on the effect of the bone dust, we thought it premature to publish them before continuing our researches. The question might arise whether the rôle of phosphoric acid in this case was not merely that of a stimulant, and whether, consequently, its action might not be subject to diminution. Further study was deemed necessary.

We proceeded with a new experiment on a Norman bull calf of the age of 140 days, whose weaning had been completed. During the milk period, in which the development is the most rapid, the animal had gained on the average 1,100 grammes per day.

Our observation covered an extent of 210 days, divided into seven periods; four of 20 days each in the stable with green food, without addition of bone dust. Between these four periods were two of 20 days each, and one of 90 days, during which we added to the other aliment 120 to 150 grammes of bone dust per day.

The daily increase was 856 grammes on the average during the 80 days in which the bone dust was omitted. It rose to 1,227 grammes in the 130 days, in which the animal received the pulverized bones. Instead of diminishing by being continued, the action of the bony phosphate was the more energetic during the long experiment of 90 days in which it was administered without interruption, producing a daily increase of weight of 1,333 grammes, almost as high as at the beginning.

In view of these results we consider ourselves authorized in concluding that the effect of the bony phosphate on the organism is not that of a simple stimulant. It is absorbed without difficulty by the blood. The bony structure, for the development of which it provides an important element, is able to appropriate it; the cellular tissue is nourished to a corresponding extent.

The addition is not only advantageous to the animal, but profitable to the owner. In the 180 days in which the bone dust was served it produced an excess in the increase of weight of 371 grammes per day, 48 kilogrammes in all, averaging 18 kilogrammes of bone dust. At the present price of 14 francs per 100 kilogrammes this represents a total expense of 2.52 francs. The cost price of the kilogramme of meat thus obtained is increased by 5¼ centimes, which is quite a moderate expense.

The facts we have given appear to us sufficiently conclusive for publication, but we do not yet intend to apply them to all cases absolutely. Our desire is to stimulate new experiments on the largest number of animals possible, and thus demonstrate whether the majority of subjects will be benefited by the action of powdered green bones or whether the favorable action depends on special aptitudes in the animal.

TRAJECTORIES OBSERVED AT JUVISY AND ANTONY.

*From the French of A. Audouard, Director of the Agricultural Station of Loire-Inférieure, and Andre Goulin, Agricultural Experimenter, in the Bulletin of the Agricultural Society of Loire-Inférieure.

Correspondence.

A UNIVERSAL LANGUAGE?

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of February 1, of this year, a correspondent who signs himself "One Who Speaks English Only" asserts that there will be a universal language "no doubt," and that this will eventually be our English. He reasons out from the fact that for expressing the same things English occupies less space in print than other languages, and, further, from the experience that the children of our immigrants invariably drop their parents' for the English language, in spite of all efforts.

It is acknowledged on all sides that a universal language would greatly facilitate the freer intercourse between the nations of the globe, but it is conceded also that the creation of an artificially made-up language would not solve the problem, as attempts toward that end have always been failures.

As pleasing as the vision of a future elevation of the English language to the lofty position of *the* universal idiom may be to the English-speaking people, it is not only much too early for such prediction, but, in view of the transitoriness of nations and their civilizations, it is unsafe to make any prediction at all.

Your correspondent's statement of the greater compactness of English as compared with other modern languages has to be taken "cum grano salis," as it must be considered in which language the thought was originally formulated and whether the translation is a good one or a poor one; that is, whether the thought has been remolded into pregnant terms of the copying language or whether the words were translated with the thought taking care of itself, after the manner of an over-enlarged photograph in which the features have lost their distinctness for a gain in diffusion of outline.

If the pregnancy of expression of thought be one criterion for the fitness of a particular idiom to become universally used, then no other language has ever had a greater chance under the most favorable conditions than Latin, which the Romans carried into all the western and southern countries of Europe as well as into western Asia and northern Africa. The European nations which passed under Roman rule were at that time in a state of demi-barbarism, and as the Romans did not only conquer them, but also took their civilization to them, which was readily adopted and imitated by those people, these latter were in such a fine condition of receptiveness for the Latin language as may probably never offer itself again to another language, at least not among the nations who for many centuries have been and still are the originators and bearers of what we call western civilization. With the cessation of Roman world-power Latin became a dead language, in spite of the great advantages which it has as a most compact and finely constructed vehicle of thought. In those days Rome did not have to deal with firmly consolidated nations with national ideas and ambitions of their own, but rather with conglomerates of tribes (except in Greece, Egypt and Palestine) more or less loosely combined by racial traditions; yet Latin as a universal language did not succeed.

Is it within reason then to claim for any of our modern languages a better successor for the future while the obstacles are so much greater?

The English language is, beyond doubt, an easy one to acquire by reason of its multitude of mono and dissyllables and the flexibility of its Teutonic syntax; but even this does not explain the secret of preference for the English language by the children of our immigrants. The true reason is a deeper one than these technical advantages of English. This preference is born from the dominating power of environment which forces the plastic material of the immigrants' offspring to accommodate itself to the traditions of their immediate surroundings. Lacking all the associations which form the "conditio sine qua non" for the maintenance of a language, even these first degree descendants of our immigrants will most naturally fall into the disuse of their parents' tongue, and instead will adapt their minds to those surroundings to which the English language is incidental.

The astonishing rapidity with which English prevails over the language of their fathers has a reason of its own. We must remember that the vast majority —perhaps 999 per 1,000—of our immigrants are not only people of very limited education, but that, in their native countries, there is a great linguistic and dialectic difference between the better endowed classes and those which furnish the emigrants, often to such an extent that the latter's power of expression is very much inferior to the average possibilities of their own language. Such is not the case with the English-speaking people, who, upon the whole, are more on a common level in the use of their mother-tongue, especially in this country. The children of our foreign element instinctively realize the difference between the clumsy and inadequate expression of thought by their parents and the comparative ease with which the English-talking people around them formulate their ideas in speech and, as a matter of course, English will become their everyday language, as it ought to be!

But it would be rash to deduce from these facts among us at home an argument in favor of English as the coming universal language. In the eighteenth century, when the nationalism of our own days with its strong incentives for international competition—in its widest sense—was unknown, the French language had become the vehicle of thought among the upper and better middle classes all over Europe, and yet the native languages did not only survive, but showed their own vitality by the way in which they gradually forced it back into its own natural borders.

In our own times, with their strongly naturalistic, not to say chauvinistic tendencies, a similar invasion of any of the modern languages into the natural domains of any of our "kultursprachen" (languages of the highly civilized peoples) is inconceivable, and without such successful invasion no language has any hope to become the universal idiom.

For the above-named reasons the rapid assimilation which is going on in the United States with the immigrating foreign element does not justify the conclusion that English will ultimately conquer the world of languages—for that it would have to be shown that it has been able to overpower, or at least is in the process of overpowering, another "kultursprache" on its own native soil, and there is no evidence to that effect on record.

That other languages, as English, within their own home where they act in unison with all environments, have the same absorptive qualities is shown by numberless instances of foreigners (English-speaking people of education included) within European countries who present the same tendency of yielding up their own languages; but these examples remain unnoticed, as no other country has anything comparable with the mixed immigration *en masse* into the United States.

The mere geographical distribution of a language cannot be considered as an indication of how near to or how far from its becoming universal it may be, as it will not only be subjected to local changes that, in the course of time, may differentiate it considerably from the original tongue, even to the extent of acquiring the characteristics of an independent idiom (the evolution of the English language itself presents a fine example of this), but it will remain dependent upon the power of political support behind it, and, in all history, this latter has been subjected to transformations which cannot be foreknown.

The Spanish language, which can be acquired even more readily than English on account of its structural simplicity and easy pronunciation, furnishes good evidence how a widely distributed language of even such technical advantages over others depends for its propagation on the political power of the nation whose inherent idiom it is. With the decay of the might of Spanish rule its geographical progress stopped, and it has hard work in keeping its own within the external limits it had reached almost 300 years ago.

The distance-obliterating means of modern communication which bring the peoples of the globe into more intimate contact than ever before only seem to pronounce more sharply the intellectual and economic differences between the nations, and instead of tempering national distinctions only seem to throw them into bolder relief and to accentuate the self-assertiveness of each nation against the others, which means a more ardent clinging to their own intellectual properties—their languages the first ones among them.

As long as such tensions caused by racial and natural differences will last there will be as little any universal language as one universal religion and universal peace. And those tensions will not disappear until the physical conditions of our globe will cease to impose different economic conditions on its inhabitants. When will that be? MAX VON SYBURG,

A German Immigrant.

Milwaukee, Wis., March, 1902.

A UNIVERSAL LANGUAGE.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of December 22 last Mr. Wilson disposes of the chance of English ever attaining the position of a universal language. If your correspondent is allowed his chief contention it must follow as he says that "there can never be a universal language," for dialects mutually unintelligible would arise in different parts of the world. But this contention is rather a shallow one. It is true that, leaving aside compensating influences, such would be the case, and here in India, we who have traveled and lived in different parts of the country, have an example before our eyes. Nearly all the languages which for our sins we have to grapple with, are easily traceable to a common source, and have broken up and corrupted from that primitive speech, till now the different districts do not understand each other's language. But these divergences grew up under conditions vastly different from those which obtain in modern times. There was no circulation of literature to hold the language together and traveling was difficult and rare; so speech was not diffused but tended to become provincial.

Now mark how this circulation of literature keeps a language, or at least the written form of it, together. Your correspondent assures me—as a mere Englishman I take his words to myself—that English as spoken in England and Scotland is so far from his form of it that he understands a German speaking his own tongue better than he understands the English of England and Scotland. Yet though my German is less than Shakespeare's Greek, I found no difficulty whatever in grasping the meaning of what appeared the very tolerable English of his letter. Here is a case in point you see. I am bound to believe that should I ever meet Mr. Wilson face to face, he would only darkly be able to make out my meaning, if I asked him the time, so to speak, whereas I should be utterly at fault at his form of English, being no Dutch scholar. Yet we should have a medium of communication—that is supposing that he is able to make out my form of English as written in this letter. I cannot but believe under the circumstances of possessing this mutual literary language that we should soon—say in a few weeks—manage to drop sign language and communicate orally, making allowances for each other's idiosyncrasies. At least I believe that we should do so much quicker on a basis of English, such as we both appear to write, than if I started in to learn French or he to learn Hindoostani (which has its points, I assure you). The moral of which is that so long as your correspondent and myself can make ourselves mutually intelligible in writing, we hold a good grip of a universal *English* language, and so long as such periodicals as the SCIENTIFIC AMERICAN appeal to our desire for knowledge in countries so far sundered, we are not likely to lose that grip.

Now with regard to the English language in English-speaking countries—the States, Canada, our own small island which we call Home, and the colonies and dependencies thereof, are we likely to wander far in speech with such a common literature to hold things together? Especially with such streams of current literature, of which I have cited your journal as an instance, constantly circulating throughout all parts of the English speaking body? It may change but it will change generally together. Do you know the influence of America on modern *English* English? You cannot pick up any journal published in England (Great Britain) without finding spread all over its columns what we used to call "Americanisms;" but which are now integral English expressions, understood in the remotest recesses of the British Isles. I cannot, of course, detect any such influences in American literature; but judging by analogy I should say they must be in evidence to an American. But with regard to us, Americans can no longer say that "start" is not a word used in our country. You will pardon me for quoting Dickens.

I am not sure that the difficulty of maintaining the spoken language as between those to whom English is a mother tongue is so great as your correspondent makes out. Take my own case. I had occasion some while ago to visit our leading dentist. You probably know his name; it is Smith—a Down East Yankee, and talks as such. After grubbing into the roots of one of my grinders—you say molars, don't you?—he let fall the observation, "*Does thet hur-r-rt anny?*" Now, by rights that ought to have proved unintelligible—it's not my form of it—yet I managed to yelp out, "*Some, in fact consider'ble,*" which seemed to be all right, for he said, "Waal, you jest act the Spar-rtan boy an' I'll fix it right away." Sir, if we can get on like that ten thousand miles away from the well of American undefiled, there is hope for English as between the races either side of the Atlantic with a slantindicular glance at the Pacific and the Indian Ocean—and that without recourse to French or Dutch.

May be the English language is imperfect as a means of communication, may be it's not; the point is that it will hold together in form by means of its literature, and that being so, we shall make shift to talk it notwithstanding our vocal organs. Maybe I'll drop my *h's* and you won't; may be I'll prefer *B* flat as a key, while you'll intone yours in *F* sharp; maybe I'll drop my final *g's*, while you'll twang yours like a harp-string; but so long as we can both read the SCIENTIFIC AMERICAN we'll make shift to allow for each other's preferences, even if we have to hark back to one common ground in one common literature to hammer out a common sentence.

What is true of us of the common blood and speech is true of aliens, as you would know if you lived in this country. Here we have daily before our eyes the spectacle of English grafting itself and growing upon the people of the country. Indian delegates with a Babel of speech from all parts of the country come together in congresses and meetings, and find a common medium in English. American, German, French, even Scotch travelers, trot about the country and find no difficulty in making their wants known wherever they can pick up a native who knows a few words of English; and they are everywhere. No trouble about the vocal chords hereabout at present. The English words, clipped and often distorted, are strong enough to convey their meaning; and right here I would point out the immense strength which exists in the simplicity of the English language as a rough and ready means of communication between alien races, which I take it is the requirement in a universal language. If you had ever heard a partly-educated native of India speak English, you would know what I mean. No flexions and inflexions, changes for mood, tense, or case, to bother about—just the root words of speech and the meaning is clear. How would French or German stand such an ordeal? You see you have not to strip English very much to get to a primitive, almost ejaculatory root speech, fit for primitive needs, and yet unmistakably English and nothing else. The Yankee who has "guessed" and "calculated" his way here, has never to guess or calculate in his dealings with a small shopkeeper say, whose knowledge of English is confined to about fifty words and not a single solitary inflexion among them. German or French would simply break down under such circumstances.

There is a practical point to note in this question of a universal language. English is the only tongue that has at present got a start (you see?) on the road. Spanish did make an attempt, but petered out, and is a back number. Where are the rest? You may take it as mathematics that no one is going to start out to *learn* a universal language. It has got to come naturally in the ordinary course of things—shoved on to you if you're a foreigner—so that you can't help yourself. Mankind is not going to sit down and absorb French in the hope that the man over the way will do likewise so that they can communicate—just because it is a pretty language—which it isn't except when it's talked prettily. Same with the others—especially when mankind knows that the strong, if clumsy, expression "Got a match?" will bring along a light for its cigar every other time. That's how a language is going to spread. You want something and you don't care a hang about the beauty of the expression that gets it for you. Now at the present day you can get a light with the above expression in more different places in the world than with all the "s'il vous plaits" and "erlauben sie uns" and other such froth put together. Those languages don't go worth a cent where they have any real work to do. They're too polite. They can't get on without their clothes. They first break up where English strips and walks in in its naked vocables, fit to win the good graces of any kindred savage. That you see is what the Norman Conquest did for us when the battle between French and English on British soil knocked the nonsense out of both of them, and gave us our all-conquering modern tongue. There is another language born of a similar conflict, which obtained a limited universality—Hindoostani, the lingua franca of India—which illustrates what I mean. The Persian-speaking conquerors and the Hindi-speaking natives clashed it out between them, as English was clashed out, and by means of the same strength it prevails throughout India to this day, and was the universal language here till English came. As I have said, Hindoostani has its points, and if there is anywhere a conscientious objection to English, I recommend it as a universal language—if people are going to the trouble to *acquire* one. It is easier than cat's cradle, and as strong as a second mate's adjuration to the crew the first day out of port.

But while people are talking about universal languages, English is growing in universal comprehension, and wherever it spreads it takes root in its literature, and while that literature flourishes it will always have a common standard, and so will remain mutually comprehensible. The languages by whose an-

alogy your correspondent argues, broke up when there were no printing press and no million circulations of cheap literature. They couldn't stay stable. They had nothing to hold on to. It is different now, and whatever language attains universality will stay comprehensible throughout for this reason. There will be provincialism of course, perhaps English in its native home, where it was hammered out, will some day sink to a provincial dialect, but throughout there will be the cementing link of educated men speaking or at least writing an educated language.

Maybe it will be French or German. The result will be the same, so long as the printing press is at work, but if it is to be any other speech than English, that speech had better pack its trunk and make a start. It can't afford to fool away any more time with English on the inside track and going steady a few leagues ahead.

Admitting that speech may likely become clipped and damaged by being acquired by foreigners, I would ask what other language stands such treatment even nearly as well as English? A case in point occurs to me. The "Breitmann" Ballads by Leland, written as they are in broken English, leaving humor aside, possess many attributes of pathos and philosophy, which it would be hard to beat in pure language, and which no foreign speech would be able to preserve from becoming ridiculous, if not used in its purity. The strength and dignity of English it may be seen is able to survive very rough treatment. It would be hard to match Stossenheim's death in the "Ride Church" as pure poetry, even though the vocables are defaced.

Throughout the above letter I have been very careful to use only our English form of English, such as is now understood under the Union Jack everywhere, and to avoid "Americanisms." Yet I think your correspondent will have no difficulty in guessing at my meaning sufficiently for all practical purposes.

Calcutta, February 18, 1902. CHARLES JUDGE.

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

Trade Conditions in Singapore.—After nearly a year of close observation here, I am prompted to write of the urgent need of American business agents in Singapore, if our exporters expect to gain a fair share of this trade. British and German houses have agents constantly on the spot, and we must imitate the methods by which they have won control of oriental trade.

Of the exports from this consular district last year, valued at $274,454,820* silver ($134,482,860 gold), 9.8 per cent went to the United States, while of $325,251,448 ($159,373,210) imports, only one-half of 1 per cent came from our country. Thus it is seen that Americans purchase in this market nearly twenty times the value of what they sell. This inequality is entirely due to want of representation of American interests.

With exports from the Pacific coast, Europe should not be able to compete, for our Pacific coast is 5,000 miles nearer the 550,000,000 buyers in Japan, Korea, China, Siam, and Polynesia than are our European competitors for such trade. Our rivals have also to pay the enormous tolls of the Suez Canal before they can land a cargo in the Orient. At present, these tolls—8s., or $1.95, per ton—are more than one-half the gross freight from Singapore to New York. Exports of tin, gambier, rubber, gutta-percha, copra, coffee, spices, etc., can thus be put into the American manufacturer's hands at $5 per ton less than the price paid by the manufacturer of Europe. Our manufacturers should not fail to take advantage of these conditions.—O. F. Williams, Consul-General at Singapore.

Yeast Wanted at Malta.—The population of Malta (183,679) may be divided into two classes—permanent and temporary. The first includes natives; the latter the soldiers and sailors of the British army and navy and families of officers. The former, in many cases, are too poor to afford meat, and are therefore obliged to rely upon bread almost wholly. To supply the demand there are, in addition to the government bakery, many bakeries run by natives. Two years ago, large quantities of wheat came here from the United States by the direct line of steamers, but for the past year, except when they came to fill army or navy contracts, there has been a falling off in consignments; however, this has been more than compensated for by the increased demand for American flour. So much of this has arrived that our only near competitors to-day are Liverpool and Trieste.

In making bread, with one exception, no yeast is used here, sour dough taking its place. Bread made from flour coming from Liverpool and Trieste has been whiter than that made from American flour, the sour dough being used in each case. If we could only get white bread from American flour, the sale of the latter would be likely to increase. After much study, I have decided that the difficulty lay in the lack of yeast. Recently, I procured a pound of compressed yeast from one of our government vessels and gave it to one of the largest dealers in American flour here, with full instructions as to the manner of using it. He writes me:

Allow me to send you a few loaves of bread, the product of American flour from the West and American yeast. I am happy to say the quality of the bread has greatly improved through the use of the yeast. My clients are now persuaded that American flour can turn out just as white and as light bread as the Liverpool flour.

An examination of the bread sent and comparison with bread of American flour made without the yeast and with that made from other flour showed marked improvement over the last two products. The bakers who tested the yeast tell me that from 5 pounds of American flour and yeast they got 7½ pounds of bread; that it was very light—something unusual in bread-making here up to this time—and very white. Those using the yeast are very enthusiastic and say that if they can get more of it they will use only American flour, because this is pure. The direct line of steamers sailing twice each month from New York to Malta takes about twenty days en route, and therefore yeast is required that will arrive here in good condition. I would suggest that those interested send me samples, together with export price quotations f. o. b. New York. I will promptly hand the former to parties interested, and tests will be made and correspondence opened upon the subject of further supplies. This is a matter that ought to receive attention on the part of American yeast manufacturers, inasmuch, as stated, yeast has practically never been in use here, and the field for it is large and permanent. I may add, in closing, that the bakers who tested the American yeast deemed the bread produced so superior that 2 cents more per loaf was charged; and several consumers requested that in future only that bread be furnished.—John H. Grout, Consul at Valletta, Malta.

Trade Openings in Lourenco Marquez.—Consul Hollis, of Lourenço Marquez, under date of January 27, 1902, says that he has received from Messrs. Wilcken & Ackermann, of that city (branch house in Johannesburg), a request for American products. The house wishes to secure the agency for steel cars, locomotives, and other rolling stock; mining and electrical machinery, pitch pine, Oregon pine, etc., from the United States. Mr. Ackermann, one of the partners, is on his way to the United States to arrange for these agencies. Mr. Hollis believes that a large trade in these lines can be created in Southeast Africa, the Transvaal, Mozambique, and adjoining states. The consul also remarks that United States firms sometimes make the mistake of giving the agency for Portuguese East Africa to a Natal house. This has been done recently in the case of a certain make of typewriters, to the serious detriment of the trade. He wishes to remind our exporters that Lourenço Marquez is not in South Africa; it is in Southeast Africa, and is the capital and chief port of Mozambique. There is nothing in common between Lourenço Marquez and the British colonies; on the contrary, they are trade rivals, and freight rates from Durban, Natal, to Lourenço Marquez are nearly as heavy, taken in connection with the transshipment charges, as the total rates from New York used to be. Mr. Hollis advises that local agents be appointed for all articles that it is desired to introduce into Mozambique, and that no reliance be placed upon subagents located in ports which are politically and economically widely separated from that province.

Trade Openings in Poland.—Vice-Consul Horodynski reports from Warsaw, February 10, 1902, in regard to the openings for American products at that point. A number of merchants, he says, desire to enter into commercial relations with American manufacturers of paper, stationery, leather work, bookbinding materials, and this line of trade generally; and they have requested the consul to send addresses, price lists, circulars, and samples, so as to enable the purchasers to become familiar with the qualities of the products.

Under date of February 12, Mr. Horodynski sends translation of a letter from the executive committee of the agricultural exhibition to be held at Vilno, in August next, which sets forth that the exhibit is not only for the purpose of showing the advance in agriculture in the districts represented, but also to enable agriculturists to study improvements in this line of industry. The committee wishes, in view of the likelihood that the commercial treaty between Russia and Germany will not be renewed after next year, to see samples of farm machinery and products from other countries, and would like United States exporters to be represented. It is possible, it says, that the German goods heretofore in use will be replaced by other foreign articles.

Fishery Exposition at Vienna.—The Department has received from the Austrian legation, Washington, under date of February 18, 1902, notice of the International Fishery Exhibition to be held in Vienna from September 6 to 21, 1902, in connection with the Eighth Austrian Fishery Congress. An invitation is extended to societies, clubs and institutions connected with fishing to participate in the exposition. Programmes are inclosed.* The exhibition will include (*a*) Fresh and salt water fish and water animals, live; (*b*) dead fish and water animals, fresh, conserved, prepared for illustration; (*c*) breeding apparatus and pearl fishery; (*d*) natural and artificial foods; (*e*) diseases and enemies of fish; (*f*) methods of fishing; (*g*) preservation and transportation; (*h*) literature and history; (*j*) manufactures from fish materials; (*k*) cooking and preparing fish for table. Applications for space are to be addressed, as early as possible, to the committee, 1 Herrengasse 13, Vienna. Steps have been taken to secure exemption from duty and reduced railway rates for goods intended for exhibition.

* Filed in the Bureau of Foreign Commerce, where they may be examined by parties interested.

INDEX TO ADVANCE SHEETS OF CONSULAR REPORTS.

No. 1297. March 24.—Japanese Mineral Products—Import Trade of Greece—* United States Glassware in Brazil—Oil as Fuel for Norwegian Vessels—Electric Railways in the English Midlands.

No. 1298. March 25.—* American Bicycles in Formosa—* Proposed American Department Store at Bombay—Coffee Crop of Brazil—* Steamship Facilities between the United States and the Levant—Railway from Chancay to Cerro de Pasco, Peru—All-Water Route to Switzerland—International Peace Congress at Monaco—* Brazilian-United States Steamship Service.

No. 1299. March 26.—Flour in the French West Indies—Canada's Mineral Production in 1901—Arbitration Treaty between Bolivia and Peru—Rubber Company in Peru—* Opportunity for American Harness and Saddlery in Syria.

No. 1300. March 27.—* Inquiry for American Agricultural Implements in Siam—Iron Ore in New Zealand—* Free List in Australia—* New Department in Honduras—* Australian Wool for the United States—Dock at Corinto.

No. 1301. March 28.—The Prussian Commission on American Railroads—* How to Increase Our Trade in Germany—Apples in China.

No. 1302. March 29.—* American Vehicles Desired in Madagascar—The New Electric Underground and Elevated Railway at Berlin.

The Reports marked with an asterisk (*) will be published in the SCIENTIFIC AMERICAN SUPPLEMENT. Interested parties can obtain the other Reports by application to Bureau of Foreign Commerce, Department of State, Washington, D. C., and we suggest immediate application before the supply is exhausted.

* Taking the value of the Mexican dollar in 1900 at 49 cents in United States currency.

SELECTED FORMULÆ.

Orange Cream.—

Shaved ice	½ tumblerful
One egg.	
Vanilla sirup	1 ounce
Orange sirup	1 ounce
Ice cream	1 tablespoonful

Fill the glass nearly full of cream, shake well, and add a little soda water.—Bull. Phar.

Furniture Cream.—

Beeswax	3 ounces
Soft soap	½ ounce
Turpentine	12 ounces
Pearl ash	¼ ounce
Boiling water	12 ounces

Melt the wax in the turpentine, dissolve the soap and pearl ash in the water, mix and stir constantly until quite cold.—Pract. Drug.

Sirup of Coffee.—

Freshly roasted and ground coffee berries	1 pound
Sugar	8 pounds
Boiling water	1 gallon

Infuse the coffee in the water until cold, then strain and dissolve the sugar in the clear liquid.—Pract. Drug.

Sarsaparilla Sirup.—

Simple sirup	40 ounces
Sarsaparilla flavoring	1 dram
Caramel to color.	—Pract. Drug.

Two Liqueurs.—

Rosolio de Turin.

Raisins	8 ounces
Orange flowers	8 ounces
Jassamine	8 ounces
Cinnamon	1 ounce
Cloves	1 ounce
Sugar	6 pounds
Diluted alcohol	12 pints
Water	4 pints

Macerate two weeks, filter and color red.

Souvenir d'un Brave.

Diluted alcohol	30 pints
Cloves	4 ounces
Cinnamon	4 ounces
Bitter almonds	64 ounces
Orange peel	2 ounces
Sugar	128 ounces
Water	4 ounces

Mix. Macerate for two weeks, filter.—Prac. Drug.

Curacoa Cordial —

I.

Tr. fresh orange peel	1 ounce
Tr. tangerine orange peel	1 ounce
Oil orange	2 drams
Alcohol	12 ounces
Water	10 ounces
Sirup	8 ounces

Mix, and at the end of a few days filter.

II.

Fresh orange peel	30 ounces
Tangerine orange peel	30 ounces
Mace	2 drams
Vanilla	24 grains
Cinnamon	1 ounce
Alcohol	2 gallons

Macerate for a week and filter. To the filtrate add

Jamaica rum	25 ounces
Sugar	15 pounds
Water	1 gallon

Dissolve, add caramel to color, and water to make the whole measure 50 pints.—Pract. Drug.

Maraschino.—

Oil bitter almonds	15 minims
Essence vanilla	1 dram
Jasmine extract	2 drops
Raspberry essence	10 drops
Oil neroli	10 drops
Oil lemon	15 minims
Spirits nitrous ether	2 drams
Alcohol	6 pints
Sugar	8 pounds
Rose water	10 ounces
Water, sufficient make	2 gallons

Make a liquor in the usual manner.—Pract. Drug.

Polish for Tan Shoes.—

I.

Petrolatum	12 parts
Yellow wax	4 parts

II.

Palm oil	1 part
Common soap	3 parts
Oleic acid	1 part

III.

Oil turpentine	6 parts
Yellow wax	9 parts
Common soap	2 parts
Boiling water	3 parts

IV.

Palm oil	2 ounces
Common soap	6 ounces
Oleic acid	4 ounces
Glycerine	1 ounce
Tannic acid	1 dram

Melt the soap and palm oil with a very gentle heat.

V.

Soft soap	2 parts
Linseed oil	3 parts
Annatto solution (in oil)	8 parts
Beeswax	3 parts
Turpentine	8 parts
Water	8 parts

Dissolve the soap in the water, and add the annatto; melt the wax in the oil and turpentine, and gradually stir in the soap solution, stirring until cold.—Pract. Drug.

TRADE NOTES AND RECIPES.

To Increase the Adhesive Power of Gum Arabic, add to 250 grammes of concentrated gum solution (2 parts of gum in 5 parts of water) 2 grammes of crystallized aluminium sulphate dissolved in 20 grammes of water. This mixture glues even unsized paper, pasteboard on pasteboard, wood on wood, glass, porcelain and other substances, on which labels frequently do not adhere well.—Papier Zeitung.

A Simple Photographic Printing Process.—Prof. Rodolfo Namias has described a very interesting and simple process in a recent issue of Photography. Two solutions are used, as follows.

A.	Green ferric-ammonic citrate	20 grammes
	Citrate acid	5 grammes
	Distilled water	50 c. c.
B.	Silver nitrate	5 grammes
	Distilled water	20 c. c.

These may be mixed when required for use, or will keep for a few days after mixing. The mixing is to be made up with distilled water to 100 c. c. A paper of good quality can then be coated with this solution. In my own case I applied it with a tuft of absorbent cotton, then dried it by hanging in a dark place, or, if required quickly, it may be dried before the fire. Printing should not be fully carried out, as the print gains in detail and strength in the after process; the image is of an orange-yellow color, and the time required about the same as for ordinary P. O. P. The next step is washing in repeated changes of water to remove the iron salt. During this washing the image gains considerably in detail, and changes to an unpleasant sickly yellow color, but on transferring to the fixing bath (hyposulphite of soda, five per cent solution), in which it should not be allowed to remain more than two minutes, it again changes to a sepia. A final washing of ten minutes in running water is all that is necessary, and the finished print can be dried by heat, and will be found to strengthen considerably in the drying. I have, as indicated above, tried this process, and can fully verify all that Prof. Namias claims for it; its only drawback seems to be a tendency to deficient half tones. I find the tone varies considerably with different samples of paper; on a cartridge paper I obtained a fine rich brown image, on a sheet of Steinbach's I had by me, one of a sepia character resulted. This method of printing is very little more expensive than the cyanotype process, and the prints are immensely preferable. It will be found very suitable for the extemporaneous production of pictorial post cards from one's own negatives, but pre-eminently applicable to the reproduction of plans, tracing, etc. The image can be toned *after* fixing in a gold and sulphocyanide bath, and the professor states that prints so toned are extraordinarily permanent, such having been exposed without protection from air and light for three years with no sign of deterioration.

Ink Powder.—

Logwood extract	500 grammes
Green vitriol	180 grammes
Gum arabic	125 grammes
Powdered sugar	60 grammes
Powdered cloves	15 grammes
Gallae, pulverized	400 grammes

The powdered cloves act, outside of their perfuming qualities, as a preserving medium; 50 grammes of this mixture furnish one liter of good school ink.—Drogistische Rundschau.

Nose Putty—Theatrical Face Paints —Nose putty has the following formula: White wax, 8 parts; rosin, white, 8 parts; mutton suet, 4 parts; color to suit. Melt together. For face paints, use the following:

White.—Oxide of zinc, subnitrate of bismuth, and plumbate of alumina, of each 1 ounce. Mix, and make into a paste with almond oil (5 to 6 drachms required), and perfume with 12 minims of peppermint oil, 12 grains of camphor, and a drachm of essence bouquet.

Bright Red.—Oxide of zinc, subnitrate of bismuth, and plumbate of alumina, of each 10 drachms; eosin, 2¼ grains (dissolved in a drachm of essence bouquet); oil of peppermint, 12 minims; camphor, 12 grains; almond oil, a sufficiency to make a paste. Mix as above.

Deep Bordeaux Red.—Oxide of zinc, subnitrate of bismuth, plumbate of alumina, of each 15 drachms; oil of peppermint, 12 minims; camphor, 12 grains; carmine, 30 grains (dissolved in 80 minims of solution of ammonia); almond oil, a sufficiency; essence bouquet, 1½ drachms. Mix. Skin color.

Vermilion.—Vermilion, 3 drachms; tincture of saffron, 2 drachms; powdered orris, 5 drachms; precipitated chalk and oxide of zinc, of each 20 drachms; camphor, 20 grains; oil of peppermint, 20 minims; essence bouquet, 1½ drachms; almond oil, a sufficiency. Mix.

Black.—Drop black (made by burning camphor and washing the soot with spirit), 2 drachms; almond oil, 2 drachms; cocoa-nut oil, 6 drachms. Mix, perfume, and cast into sticks.

Crayons for Writing on Glass.—Chalk does not enter into these, in any shape. The following is a good formula:

Spermaceti	4 parts
Tallow	3 parts
Wax	2 parts
Red lead	6 parts
Potassium carbonate	1 part

Melt the spermaceti, tallow, and wax together over a slow fire, and when melted stir in, a little at a time, the potassium carbonate and red lead, previously well mixed. Continue the heat for 20 minutes or half an hour, stirring constantly. Finally, withdraw from the source of heat, and let cool down somewhat, under constant stirring, at the temperature of about 180 deg. F.; before, however, the mixture commences to set, pour off into molds and let cool. The latter may be made of bits of glass tubing of convenient diameter and length. After the mixture cools, drive the crayons out by means of a rod that closely fits the diameter of the tubes.—National Druggist.

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